

FY 2003

**Annual Report
-of-
University of Illinois Extension
-and-
Illinois Agricultural Experiment Station
-to-
Cooperative State Research,
Education and Extension Service
CSREES-USDA**

**University of Illinois Extension - Office of Extension and Outreach
-and-**

Illinois Agricultural Experiment Station - Office of Research

**College of Agricultural, Consumer and Environmental Sciences
University of Illinois at Urbana-Champaign**

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UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

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Acknowledgment and Preface

This report has been developed to fulfill the requirements of the Agricultural Research, Extension and Education Reform Act of 1998 (AREERA) which amended the Smith-Lever Act, the Hatch Act and the National Agricultural Research, Extension and Teaching Act of 1997. AREERA focuses on funding through Smith-Lever 3(b) & 3(c), Hatch, McIntire-Stennis, and Evans-Allen. Other funding avenues such as the Smith-Lever 3(d), NRI, and other grants and projects are reported separately. This report is the fourth annual report under Illinois' current five-year plan of work with CSREES-USDA.

Consistent with the CSREES Annual Report Guidelines this annual report addresses some but not necessarily all of the issues in the plan of work.

Interpretations of AREA have strictly limited those activities which can be claimed as jointly-funded Extension and Research activities as well as what can be claimed as multi-state Extension activities. As a result of these interpretations, this report fails to disclose the extent to which integrated and multi-state activities now represent the way the College does business. The College has decades-old ties with sister institutions and personnel based in other states. Over the past decade which has witnessed a reorganization of the College and U of I Extension, a guiding principle has been to integrate research and extension so that the citizens of Illinois can be better served.

For the content of this report, the reporting team has drawn heavily on the work of the College's Department of Information and Technology and Communication Services' (ITCS) Public Affairs Section under the leadership of Gary Beaumont.

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A. Programs

Note on Key Themes reported by Goal: Illinois has chosen to report on some key themes that were not specifically named in the state's original Plan of Work. This is done because of the interest that the federal partner has expressed by listing all of the themes found in the respective plans of the states and territories.

The College of Agricultural, Consumer and Environmental Sciences (ACES) is all about science that matters – with students, faculty, and Educators who are committed to making life better, healthier, safer, and more profitable for people all over the world. The original land-grant mission of the University envisioned opportunities to apply the knowledge of many disciplines to problems that matter where people live, work and grow. In ACES, that means extending discovery and learning across the landscape of the entire food chain, managed and natural resource systems and individuals, families, and communities. ACES will help to shape the social, biophysical and cultural domains that will surround that landscape for decades to come through our students, our science and our ability to reach others. As we seek to redefine this space, the College's mission today is fulfilled centrally by faculty efforts in teaching (80.8 FTE), research (119.56 FTE), and Extension education (35.19 FTE).

Structural Changes: Leadership changes continue to reshape the College of ACES. Over the past two years, a new Dean and five new department heads were appointed, including permanent appointment of a department head in Animal Sciences this year. National searches are commencing for new leadership in Crop Sciences and in Agricultural and Biological Engineering, as two more heads retire. At the conclusion of these searches, every department will have changed leadership since 2002. The former Department of Agricultural Engineering was renamed this year to reflect the increasing biological emphasis in its domain. The Associate Dean for Research was named Director of the National Soybean Research Laboratory, in addition to shouldering responsibilities as Director of the Illinois Agricultural Experiment Station and Interim Director of ACES Global Connect. The Assistant Dean and Director for Illinois 4-H Youth Development resigned to pursue an opportunity in another state.

Impacts of Budget Rescissions and Reductions

For FY 2004, larger base reductions were again taken from the College's administrative (-10%) and service units, such as Information Technology and Communication Services (-14%), to protect the academic departments and Extension (-5.5%) to the extent possible. Vacant lines and attrition

accounted for 100% of the faculty reduction, 40% of the academic professional reduction, 20% of the staff reduction, and 100% of the assistant reduction. Personnel were moved to other sources of funds where it was feasible, including 25% of the base reduction for academic professionals and 20% of the base reduction for support staff. Terminal contracts and layoffs accounted for 35% of the base reduction for academic professionals (8.0 FTE) and 60% of the base reduction for support staff (26.27 FTE).

University of Illinois Extension suffered reductions in three areas of the FY 2004 state appropriations process. From the University's base budget reduction, Extension lost \$575,913, collapsing 1.0 FTE academic position and 2.5 FTE clerical positions, layoff or termination of 13.06 FTE clerical positions, and shifting 1.5 FTE clerical positions to other funding sources. In addition, the general support line for Extension in the Illinois Department of Agriculture was reduced from \$3,209,600 in FY 2003 to \$1,966,300 in FY 2004. Primarily in place to support Youth Educators in local units, the reduction of this line item resulted in a net loss of 17.0 FTE, separate from the base reduction. Several terminal contracts were issued, some to educators hired within the last two years. The state appropriation for County Board Match experienced a mid-year rescission in FY 2003 of \$959,450 on a base budget of \$10,865,000 (-8.8%). In FY 2004, the base appropriation was reduced to \$10,321,700. County Board Match is the state's obligation to match funds committed by local entities to Extension. Federal funding for Extension was also reduced in FY 2004, including reductions of \$54,784 in Smith-Lever formula funding, \$216,657 in food and nutrition education, \$29,266 in pest management, and other miscellaneous reductions.

The Illinois Council on Food and Agricultural Research (C-FAR), which is funded from state appropriations as a separate line through the Illinois Department of Agriculture, has experienced severe reductions. Starting in FY 2002, the state appropriation of \$15 million was reduced by 2% in mid-year. The FY 2003 budget was slashed to \$6.968 million and the FY 2004 budget was cut to \$5.0 million, curtailing internal grants for the participating universities and allowing for only a limited managed research portfolio. These reductions translate to a severely reduced capacity to engage in research projects that are of specific interest to stakeholders in Illinois.

Affected academic programs included agricultural and environmental communications, rural sociology, family studies, hospitality management, consumer behavior, weed science, soil science, forest science, and dairy nutrition. Dropped course offerings and loss of teaching assistants

resulted in the loss of over 1,100 seats for students in ACES courses in the current academic year. This is likely to have proportionately more impact on course seats for non-majors. Due to the lack of program capacity, the College cannot optimally address specific opportunities, such as food security, family resiliency, community and economic development, and research and education centers. Statewide Extension Educator capacity was seriously eroded with the 40% reduction in general support funding for Youth Educators.

Over the past two years, the College's cash reserves were effectively eliminated, curtailing future flexibility to help fund multi-year commitments, startup costs, spousal accommodations and other continuing issues. The faculty start-up model generally requires forward deficit financing to provide competitive packages. The College also gave up discretionary ability to fund various items, such as the value-added fellowships from the Office of Research. Academic units are increasingly concerned about their reliance on indirect cost recovery to fund critical teaching and staff support functions. Disproportionate reductions in support staff in academic units has resulted in greater program support deficiencies, while the added short-term burden of Banner implementation falls primarily on program support personnel.

Budget Redirection: Budget reductions mean that demands will not be met and opportunities will be lost. A smaller faculty translates to abandoned research programs, jeopardized curricula and less outreach to stakeholders. For FY 2004, the College's state appropriated base budget was reduced by 6.2%. Larger base budget reductions were absorbed by administrative (-10%) and service (-14%) units relative to the academic and Extension programs (-5.5%) of the College.

Major Initiatives

South Farm Development: Phase one of the South Farm modernization is underway, with infrastructure installations and the new beef and sheep unit under construction. Key parcels of land, necessary for phase two, are being procured, while others are pending resolution. The phase two funding mechanism has yet to be determined, but exciting opportunities for integrative approaches to science are emerging with respect to the South Farms field laboratory system. Construction of Christopher Hall will begin this spring to house the family resiliency program. The USDA greenhouses are scheduled to begin construction this spring. The College is anxious to see the full potential of the Institute for Genomic Biology realized, with building about ready to begin.

South Farms offers not only a classical research and education site, but they represent a tremendous opportunity for a landscape model of research, vindicating the wisdom not to locate the new farms far away from campus. Novel opportunities for long-term agricultural and ecological research and education stem from the unique 4,500-acre site adjacent to both a great university and an urban area, the presence of riparian headwaters, diverse uses of natural resources, and ideal timing. The National Science Foundation articulated a concept for long-term agroecological research and education, and the South Farms offer a high visibility site for convergence of those and other interests. Umbrella and baseline information that may be obtained with the South Farms to characterize the full spectrum of potential uses would create substantial research interest.

South Farms revitalization was originally part of a plan to modernize the statewide system of food and agricultural research and education centers. This system helps to support the College's integrated approach of combining research and Extension. The centers in various locations suffer from deferred maintenance, shoddy equipment and shortages of land for modern experimentation. Revolving and recurring operating resources are severely lacking to sustain all of the Research and Education Centers, including the South Farms. The most critical issue is the financial pressure that competes with other urgent needs in the academic units. The system produces valuable knowledge and information, and there are important emerging opportunities for research and education, such as the "green" industry, alternative agriculture, urban landscapes, bioprocessing, and animal industry development. The College recently helped to establish the National Great Rivers Research and Education Center in cooperation with Lewis and Clark Community College and the Illinois Natural History Survey.

Cross-Campus Initiatives: ACES faculty have come forward to lead cross-campus initiatives. ACES is contributing significantly to the food security initiative and the family resiliency initiative and to play a leading role in aging initiative. ACES faculty members are contributing partners in initiatives being led by faculty in other campus units.

Academic Instruction: Undergraduate enrollment in ACES decreased (2.8%) to 2,180 in the fall of 2003. The yield of freshman admissions was 74.7 %, remaining above the campus average. The undergraduate composition of ACES is 60% female, 7% minority, and 3% non-Illinois residents. The College advocates a total enrollment management plan for 2,600 undergraduates that would be more meaningful than a freshman admissions model.

Transfers to ACES are an important component of several majors, so the College is recruiting up to 100 additional community college transfer students. ACES offers 12 undergraduate degrees with 42 major options and nine minors and awarded 440 bachelor's degrees in CY 2003. Instructional units in the College increased 4.03% from 61,686 (01-02) to 64,178 (02-03). Instructional units earned by non-ACES students grew by 6% to 19,668. The College distributed more than \$800,000 from all sources for undergraduate scholarships, including the Jonathan Baldwin Turner Freshman Merit Scholarship Program. Nearly 70% of ACES graduates have internship experiences, 89% paid and 41% for academic credit. Nearly 35% of the baccalaureate graduates continue immediately with graduate or professional education.

Resident graduate student enrollment remained flat at 570, given fewer faculty members and stronger employment opportunities, especially for domestic U.S. candidates. Current graduate students in ACES are 50.2% female, 49.8% male, 4.4% minority, and 39% foreign. The College has eight graduate programs, offering M.S. and Ph.D. degrees, and three extramural M.S. programs. Graduate degrees conferred in CY 2003 included 95 masters and 25 Ph.D. degrees. The College sponsored 119 graduate fellowships this year from all sources.

Planning Processes: ACES cannot rest on its laurels even in fiscally challenging times, so many of the College's internal and external stakeholders have invested significant time and effort over the past year to chart our course into the future. When visionaries consider the changes happening or about to happen across the globe and throughout the local landscape in our domains of interest, exciting ideas emerge. The College aspires to exceed expectations as a high performance institution of higher learning. During the year, leaders and participants in the process have grappled with what it means and the steps necessary to be globally preeminent and locally relevant. Resulting from a process that included College leadership conclaves and a strategy conference at Allerton in March 2003, task forces have examined the identity and culture of ACES and are preparing to apply what we learn to achieve our preferred future through strategic relationships, leadership, governance, and management.

As part of an ongoing long-range planning process, U of I Extension initiated key informant interviews across the state during the summer of 2003. Center-based, regional Educators interviewed leaders of commodity groups, campus faculty and local producers to identify key issues facing Agriculture, Natural Resources and Commercial Horticulture. Special attention was given to involve informants who had not been involved in past program planning efforts. The issues identified

through this process were found to fit within six broad themes: 1) Environmental Stewardship - Rural and Urban, 2) Farm Business: Profitability/Sustainability, 3) Human Resources Development, 4) Rural-Urban Residential Relations, 5) Bio-Security, and 6) Growing the Illinois Economy through Agriculture. Starting in the fall of 2003, local Extension Units are involving citizens in identifying which of the statewide identified issues are of high priority for their Units and will be communicating this local information to Extension's Program Leadership Teams. During Spring and Summer 2004 Program Teams will be using this local information in the development of long-range plans of work.

Marketing: Inherent in our strategic planning is the grand promise that ACES makes for higher education, science and outreach in our domains of interest, the set of features, benefits, and services that will set ACES apart. The College continues to invest in understanding the needs and demands of our changing customers, clients, and audiences.

Diversity: With fewer resources, opportunities to meet diversity goals are more limited, but ACES continues to seek diversity with excellence. Of the nine new faculty members that started in the College this fiscal year, two were female and one represented a minority group.

Partnership value: The College is seriously examining the changes to our external environment, listening to our stakeholders, and redefining our paradigms and domains of operation. Through our planning processes, we recognize the changing demographics of the College's constituencies, as well as the changing economic, social, and technological landscape. Partner relationships are highly valued in ACES. Private and public organizations regularly seek assistance from ACES faculty and draw on unique expertise in entities such as the National Soybean Research Laboratory. Policy makers have called upon the College for input on issues such as federal farm and agricultural research policy, food safety, animal industry development, and global climate change. Numerous other examples indicate that stakeholders value direct relationships with the College, both on-campus and off-campus.

The College extends its reach with tools like *Farmdoc*, <http://www.farmdoc.uiuc.edu/>, an acclaimed online source for research-based outreach. The College's research engine underlies our ability to have impact through such tools. In some areas, such as community and economic development, the dwindling faculty research base has been unable to keep pace with demands for Extension educational programs.

Research and Extension coordination: The key links between research and extension are the campus-based subject matter specialists and the center educators. Partial restoration of extension faculty positions was included in the University's budget request for FY 2004, but the \$300,000 request did not survive the state budget process. The University requested \$200,000 in the budget request for FY 2005. The College has firmly established the linkage in our planning and reporting functions with federal partners.

C-FAR: Funding for C-FAR remains highly vulnerable in the current state budget environment. As previously noted, the C-FAR appropriation has declined by two-thirds since FY 2004. Not only does this limit the near-term ability of our faculty and research professionals to address problems of interest to stakeholders in Illinois, but it also affects decisions on faculty hiring and research orientation that will last far into the future. The College needs to hire faculty who can work in areas where they will find the resources to succeed.

University of Illinois Extension: Extension provides educational programs throughout the state, in local units, in regional centers, and from campus-based specialists. Loss of center educator capacity and fewer faculty specialists threaten Extension's ability to meet needs in core program areas and weaken the connections with the stakeholder base. Local support and associated county board match from the state is critical to local units. But support has waned in some local units, for example in Peoria County, as tax caps create funding pressures for counties. Extension Partners has become a formidable stakeholder organization, advocating for a stronger Extension system.

Performance-based management: As part of the College's annual planning process, the College leadership began to consider principles for potential management changes, such as permanently rewarding departments for establishing large courses that serve non-majors from across campus. Other aspects of performance-based management will be examined in the course of work for College task forces. ACES Academy of Teaching Excellence offers additional guidance and training oriented towards implementation of performance assessment systems.

New campus buildings and facilities: Several capital projects are coming to fruition this year. Funded by a generous donation from the founder of the Pampered Chef, construction of Doris Kelley Christopher Hall will begin in the spring of 2004 and open in September 2005, housing the family resiliency program. Starting this spring, two new ranges of greenhouses will be constructed by USDA's Agricultural Research

Service adjacent to the existing greenhouse complex. Remodeling the former agriculture library space will also commence this spring in Mumford Hall. The Child Care Resource Center was relocated to a common remodeled location in Bevier Hall, and the basement of the Animal Sciences Laboratory is currently in the remodel design phase. Awareness of the opportunity to build the Food and Nutrition Institute, as approved by the Board of Trustees, aims to leverage our considerable strengths in this area. In a closely linked strategy, stakeholders and members of Congress have indicated strong interest in establishing a World Food and Health Program at Illinois.

Opportunities to Address

Global engagement: ACES' future is locally relevant and globally preeminent. Given global trends, only a few really significant institutions of our kind will exist in the next generation. The College of ACES aspires to be one of those few. This is discussed in more detail below.

Leadership initiative: Leadership development is a key area of emphasis in the College of ACES, most strongly institutionalized in our agricultural communications and agricultural education programs. Programs also in place through University of Illinois Extension provide the essential base for outreach programs on leadership development. The College can provide intellectual and structural underpinnings to partner with the campus to develop the leadership curricula and programs that will serve students across campus.

Scientific literacy and communications: Specific emphasis on raising the level of scientific understanding, increasing awareness of the role of science in society, and communicating scientific knowledge for adaptation and application among the academy's audiences is a signal opportunity for a next-generation land-grant institution. ACES and Extension are uniquely positioned to leverage their existing assets and move in this direction.

Executive and professional education: The College already has successful graduate degree programs aimed at professionals in crop sciences, food science, and natural resources and environmental sciences, as well as numerous short-term and certificate programs. Additional opportunities have been identified in areas such as international food marketing and international leadership. Questions about funding stability and fit with core missions must be answered.

Public policy engagement: Food, agricultural, and community leaders play crucial roles in state and national policy relating to trade, intellectual property, transportation systems, regulatory matters, and funding for research, extension, and education programs in their spheres of interest. The new Gardner Chair in Agricultural Policy indicates the essential role of the College in state and federal policy issues.

Human and family resiliency: The mission of the College of ACES explicitly emphasizes a commitment to quality of life for people, individually and socially. Our commitment to the concept of family resiliency, supported now by the campus initiative on family resiliency and the major donations for Christopher Hall and the endowed chair in family resiliency, is building a platform for unparalleled scholarship related to resilient individuals, families, and communities.

Food, nutrition, & health: The interdisciplinary opportunities to address issues of disease prevention, obesity, food bioactivity, and global nutrition are manifest on this campus. Our history of integrated research, instruction, outreach, and interdisciplinary collaboration is clearly evident, the World Initiative on Soy in Human Health, work in functional foods, and chemo-prevention of cancer and other diseases. The effort to establish the Food and Nutrition Institute will pay substantial dividends to the University.

Food security/safety: Raised to the level of a campus initiative, the emphasis on food security and safety offers a multitude of opportunities for novel approaches to complex systematic problems. This area is of keen interest to public and private partners, who are forging new relationships with the College and the University.

Biotechnology: Our future is strongly associated with the commitment to molecular biology. Investment in biotechnology, including genomics and its functional derivatives, remains a top priority. Multiple integrated dimensions will be enhanced by the completion of the Institute for Genomic Biology, from animal and plant genomics and bioinformatics, to metabolism, comparative physiology and nutrition, and whole organism biology, to the socioeconomic implications of biotechnology.

Food systems: The College of ACES has redoubled efforts and strengths in food value chains and consumer behavior where we can truly be a globally preeminent intellectual center. It is important that we consider the needs of all the links in food systems and the opportunities to partner with each one.

Integrated landscapes: Landscape implies continuum rather than bounded systems in our vision. The concept of integrated landscapes concerns quality, processes, and products, addressing issues of systems biology and biocomplexity to precision technology and management. Issues pertaining to urban-rural interface dominate much of the strategic agenda, due to changing demographics, urbanization, land use, environmental impacts of agriculture and human activity, economies of scale in the food and agricultural sector, and emerging opportunities for “green” industries (horticulture to turfgrass), companion animals, restoration ecology and wildlife, and value-added agriculture. The South Farms is the ideal future laboratory for these concepts.

Bio-based initiatives: The College is well positioned for leadership on campus for issues related to the management and use of bio-based resources for benefits to society and the environment. Significant research efforts already exist in ACES, related to air, water, renewable energy, bio-based resources, and bio-refining. The College has the potential to bring together a nationally prominent critical mass of assets around sustainable agricultural, food, and energy systems.

South Farm: The South Farm is a tremendous opportunity to create a campus resource for field research and education to investigate complex problems across the biological, physical, environmental, social, and economic landscape. In concert with research park development, new opportunities for bio-based industries are possible, along with a host of other integrated applications for novel research.

E-Extension: Internet and related technologies portend enormous opportunities to expand the reach and impact of outreach and extension activities in the future. University of Illinois Extension is participating in the national planning for this exciting innovation in educational delivery methodology.

Indications of the Scope of Research and Extension Programs under Goal 1 - See Appendix A.

As in previous years, about two-thirds of the College's research portfolio is invested in Goal 1 projects. Roughly 18 percent of Extension's efforts have been directed toward Goal 1 educational activities. Extension activities under Goal 1 included more than 310,000 face-to-face teaching contacts by Extension-paid employees.

CSREES GOAL 1 – An Agricultural System That is Highly Competitive in the Global Economy

Indications of the Scope of Research and Extension Programs under Goal 1 - See Appendix A.

Key Theme – Agricultural Competitiveness

Legal Issues Affecting Agriculture: Local, State, National, and International Perspectives

- a. Continued research on multifunctionality in agriculture, in light of WTO negotiations, resulted in two chapters and co-editorship of a book scheduled for publication in 2003. Research continued under a C-FAR SRI on regulation of livestock waste and odor, resulting in updates to an educational website and work on an article. Related research as part of a 16-member National Research Council committee resulted in a published interim report and a final report (in press).

Additional research focused on legal issues on agricultural biotechnology, with particular emphasis on federal regulation and potential tort liability of producers and seed companies. This work resulted in two invited papers at international meetings, two law review articles, and several continuing legal education programs. Another invited law review article will be published in the United Kingdom in 2003. Continuing research on the regulation of grain elevators and the impacts of elevator failure resulted in outreach programs reaching producers, elevator owners and state legislators.

- b. Impact - Research on federal regulation of genetically modified crops and potential state tort liability has helped international lawyers and attorneys in the United States better understand the regulatory and tort systems affecting GMOs in the U.S. This research has also helped producers better understand liability

issues and adjust their conduct to reduce the likelihood that the planting of genetically engineered crops in the U.S. will adversely affect export markets for U.S. grain.

- c. Source of Funding – Hatch, State Funds
- d. Scope of Impact – National

The Effects and Causes of Agricultural Policy in its Domestic and International Contexts

- a. A questionnaire was developed to attain information on consumers who patronize farmers' markets in the Dominican Republic and analyzed survey data. The findings reveal the reasons why consumers shop at the markets, their expectations of farmers' markets compared to other outlets, and willingness to purchase organic products. The results are important because farmers' markets can be used as a strategy to increase farmers' income.

The research highlights economic and non-economic factors that are important to consumers who purchase produce and other goods at the farmers' markets. It provides insights into marketing strategies and operations that may be critical for sustainability of the markets. The findings reveal reasons why farmers sell their products at the markets and problems they encounter in participating in the markets. The research reveals that farmers participate in the markets for both economic and non-economic reasons and that a large percentage of farmers encounter problems in participating in the markets.

- b. Impact - The research provides information that is useful to sustaining the newly developed farmers' markets in the Dominican Republic. Farmers' markets can enhance farmers' income but for the markets to remain viable it is important to understand the motivations of farmers and problems that they experience in participating in the markets. Similarly, consumers' expectations and concerns must be identified and addressed to ensure sustainability of the farmers' markets.
- c. Source of Funding – Hatch, State, Federal, Industry Grant Funds
- d. Scope of Impact – National

Key Theme – Agricultural Profitability

Development of Processes to Recover and Utilize Agricultural Biosolids

- a. Co-products contribute significantly to the economic viability of the corn processing industry. One need of the industry is detailed information on the characteristics of conventional co-products and the process streams leading to their production. In the corn wet milling industry, two streams, light gluten (LG) and light steepwater (LSW), are affected by processing conditions during wet milling of corn and vary in composition. These streams are precursors of two co-products, corn gluten meal (CGM) and corn gluten feed (CGF), used as animal foods.

Variation in composition of LG and LSW affect nutritional quality and market value of both co-products. Material not usable in LG or LSW streams becomes part of the wastewater stream and incur costs associated with lost corn solids and treatment of waste. As part of this study, characteristics of corn wet milling co-products and intermediate streams were determined. Variability in co-products CGM and CGF were found to be large, indicating that this will reduce the value of these co-products from the wet milling industry. Variability was due in part to the process streams leading to the production of CGM and CGF. These process streams, LG and LSW, were found to vary in dry matter, total nitrogen and ash content.

- b. Impact - Variability of co-products such as CGF and CGM reduces the value for the corn wet miller. From our detailed characterization of processing streams, the processor may evaluate opportunities to reduce variability and to develop new co-products. For example, this study revealed that high ash content reduced in steepwater may provide a market opportunity for improved CGF. Higher revenue from improved CGF would enhance the profitability of wet milling and increase demand for corn.
- c. Source of Funding – Hatch, State, USDA Grant Funds
- d. Scope of Impact – National

Optimization of Agricultural Production Facilities for Entrepreneurial Business

- a. Continued work on the optimization of production facilities has resulted in new types of teaching tools that will allow the owners/operators of small-to-medium sized facilities that are facing expansion difficulties. The work will give these companies the ability to analyze and achieve a pareto-optimal solution to production and systems problems that are often the hidden cause behind productivity lags.
- b. Impact - The impact of this work has already been demonstrated in a pilot trial at a large food manufacturing plant. During the trial, the methods devised in the course of this project were applied to a production line that was found to be operating at a less than optimum capacity. Using the modeling techniques developed in the course of this study, the single trial line was able to recover 6% of its production capacity. This represents an increased productivity equivalent to \$1.6 million per year and required no capital investment.
- c. Source of Funding – Hatch, State, Other Non-Federal Funds
- d. Scope of Impact – National

Illinois Farm Management 2003 (FAST) Workshops

- a. University of Illinois Extension and the College of ACES Department of Agricultural and Consumer Economics provide farm operators and owners, agricultural lenders and managers of farm-related businesses the opportunity to participate in "hands-on" training in the use of Excel spreadsheets designed to aid in farm-level decision-making. The Illinois tools are called the Farm Analysis Solutions Tools (FAST).

During the winter of 2002-3 a total of 147 individuals attended nine FAST workshops held across Illinois. These individuals were asked to complete a mail-in questionnaire.

- b. Impact - With 92 responses (response rate of 63%), the following results were obtained:

98% found the computer lab useful

92% would attend a similar session covering different FAST tools, respectively
92% thought the workshop was well worth their time and effort
96% thought the FAST tools were valuable

On average, 78% of the respondents reported they felt each of the FAST tools were "useful" or "very useful."

48.9% actually used FAST in making crop insurance decisions
43.7% used FAST in budgeting for the 2003 crop year
34.2% used FAST in determining how much to pay for cash rent
30.2% used FAST in making machinery acquisition decisions

- c. Source of Funding – Federal, State
- d. Scope of Impact - Illinois

Key Theme – Animal Health

Functional Food Ingredient Effects on Canine Nutrition and Health

- a. Pets are big business. The pet industry as a whole amounts to \$39 billion worldwide, with \$27 billion of that in pet food alone. In fact, 37% of households in the U.S. own a dog. And pet owners like to keep them healthy. Dogs suffer gastrointestinal problems, too, like constipation, diverticulitis and inflammatory bowel syndrome.

To find answers to digestibility questions, researchers need access to the dog's gastrointestinal contents. It is necessary to know more than just what is being fed and about the nutrients excreted in feces. In order to access the gastrointestinal material, a tube is inserted into the dog's terminal ileum – the last part of the small intestine. A sample is collected before it reaches the large intestine where the microbial population breaks the food down. The procedure is comparable to an ileostomy in humans except that unlike an ileostomy in which the large bowel is removed so the person no longer has a colon; in the dog, nothing is actually removed.

- b. Impact - Pet food companies have benefitted from the unbiased research provided by the University of Illinois by being able to utilize the information to develop healthy recipes for pet food and reduce gastrointestinal problems.
- c. Source of Funding – Hatch, Industry Funds
- d. Scope of Impact – National

Effects of Extruded Fiber on Digestibility and Gastrointestinal Characteristics

- a. Fiber is a heterogeneous material that can be categorized into two major subclasses: viscous fiber (soluble) and non-viscous fiber (insoluble). These two subclasses have different effects on the digestive and absorptive processes in the gastrointestinal (GI) tract. Viscous fiber forms a gel in the GI tract and is highly fermentable. On the other hand, non-viscous fiber is associated with a decreased intestinal transit time, increased fecal bulk and poor fermentability. Very little information is available regarding how processing affects the distribution of these fiber fractions in feedstuffs.

Therefore, in order to establish a fermentation profile, six fibrous substrates (soy hulls, soy flour, wheat bran, oat bran, corn meal, and barley grits) were selected and were extruded using three different extrusion conditions (mild, moderate and extreme temperatures). Four blends of cellulose and pectin were included as controls in order to represent a purely non-viscous, non-fermentable fiber (cellulose), and a viscous, fermentable fiber (pectin). All substrates were subjected to a three-stage monogastric in-vitro fermentation assay that simulated small intestinal enzymatic digestion prior to fermentation with porcine fecal inoculum. This was done in order to establish the profile of short chain fatty acid production, as well as to determine viscosity of the original and extruded fiber sources before GI fermentation. Currently, the results are being summarized and will be written in a journal manuscript to be submitted to The Journal of Agricultural and Food Chemistry.

- b. Impact - Viscous and non-viscous dietary fibers impact intestinal health in divergent ways. The data generated by our research will help elucidate how practical feedstuff sources of these fibers are affected by selected processing conditions. This, in turn, will reveal how processing conditions of fiber can be optimized in

order to improve applications of dietary fiber for gastrointestinal tract health.

- c. Source of Funding – Hatch, State Funds
- d. Scope of Impact – National

**Porcine Reproductive and Respiratory Syndrome (PRRS):
Mechanisms of Disease and Methods for the Detection,
Protection and Elimination of PRRS Virus**

- a. The immune response of pigs to infection with wild-type virus or vaccination with a conventional modified live virus (MLV) vaccine against the arterivirus Porcine Reproductive and Respiratory Syndrome virus (PRRS) is characterized by an initially weak IFN-g response that increases gradually over a period of months. Our studies have shown that this response cannot be enhanced by the inclusion in the vaccine formulation of a conventional oil-in-water adjuvant which otherwise significantly increases the IFN-g response to the highly immunogenic MLV vaccine against pseudorabies (PR) virus, a herpesvirus of swine. In contrast, inactivated vaccines against either PRRS virus or PR virus containing a similar adjuvant were unable to elicit the development of a virus-specific IFN-g response. The co-delivery of plasmid encoding porcine IL-12 or porcine IFN- α along with the PRRS MLV vaccine increased the intensity of the primary PRRS-virus specific IFN-g T cell response to PRRSV at least three-fold.

While the enhancing effect of the IL-12-containing plasmid on the intensity of the IFN-g response was transient, the enhancing effect of the IFN- α encoding plasmid was maintained for several weeks. The enhanced IFN-g response was also evident during the booster phase of the response upon challenge with virulent PRRSV at 9 weeks after vaccination. The results obtained indicate that the immune response to vaccination with PRRSV can be enhanced by exogenous cytokines. Injection of exogenous cytokines in the form of plasmids containing cytokine cDNA might have an application in the formulation of a new generation of highly effective vaccines. Passive immunization with sera containing PRRS virus-neutralizing antibodies has been shown to confer not only protective but also sterilizing immunity (Osorio et al, 2002). However, the production of neutralizing antibodies as a result of infection or vaccination with PRRS virus is not a consistent event and most pigs either only develop low titers of virus-neutralizing

antibodies or none at all. For this reason we have been examining the possible correlation between the intensity of the PRRS virus-specific IFN-g response and protective immunity.

So far three independent studies have suggested a positive correlation between these two parameters. In the first experiment a positive correlation coefficient of 0.61 ($P=0.0013$) between the frequency of PRRS virus-specific IFN-g-SC in the lymphocyte population of previously MLV-immunized sows at the time of virulent PRRS virus challenge (90 days of gestation), and the number of subsequent live-born piglets was obtained. In the second experiment we observed that in a routinely vaccinated sows at a commercial facility, only those with a frequency of >150 PRRS virus-specific IFN-g SC/106 PBMC did not abort as a result of exposure to a natural outbreak of PRRS during their pregnancies. In the third experiment, in a group of pigs in a commercial farm with endemic PRRS, a positive correlation was observed between the intensity of the IFN-g response to PRRS virus and reproductive performance.

- b. Impact - Understanding of the mechanisms that regulate the development of anti-viral protective immunity will lead to the development of more effective vaccines and methods to control this pathogen. Discernment of how immunity impacts the severity of clinical disease on commercial farms will lead to the development of improved strategies for managing PRRS in reproductive herds using strategies such as vaccination.
- c. Source of Funding – Hatch, State, Multi-State Research Funds
- d. Scope of Impact - IA, IL, KS, MN, MO, NC, ND, NE, SD, VA

Determining if Dogs Transmit the Agent of Bovine Neosporosis More Than Once

- a. *Neospora caninum* is a protozoal organism that is one of the most common and economically important causes of abortion in dairy and beef cattle. Cattle can become infected when they consume feeds or graze pastures that have been contaminated by dog feces. Dogs transmit *Neospora* to cattle by shedding infectious oocysts in their feces, after they have consumed infected tissues from cattle or other animals. In our laboratory, dogs only shed *Neospora* oocysts for a period of about 10 days. It is unknown if these dogs will ever

shed *Neospora* oocysts again, or if they develop immunity that prevents further shedding of oocysts.

For the current project, we induced five dogs to shed *Neospora* oocysts. Since the initial infection, the dogs have been checked weekly in order to determine if they have resumed shedding oocysts. So far, this has not occurred. In addition, the dogs are to be reinfected by having them consume fresh, infected bovine tissues and then the dogs will be checked daily to see if they re-shed oocysts or if they are immune. We reinfected two dogs after eight months, and they did not shed oocysts. Three more dogs have been kept for more than a year and will soon be reinfected to determine if they are still immune. Results will be compared to positive control dogs. The answer is important. If dogs develop solid immunity to *Neospora* oocyst shedding, then development of a controlled exposure program, or of an oral vaccine for dogs, will be a practical goal to help prevent transmission of *Neospora* from dogs to cattle.

- b. Impact - If, after an initial infection, dogs develop solid immunity that prevents shedding of *Neospora caninum* oocysts in the future, then this will enable us to develop programs (controlled exposure or oral vaccination) to prevent dogs from transmitting this organism to cattle.
- c. Source of Funding – Hatch Funds
- d. Scope of Impact – National

Risk of Bovine Viral Diarrhea Virus (BVDV) Post-Natal Infection in Illinois Cattle

- a. This project is assessing the factors that influence the rates of transmission of BVDV in the cattle herd. We currently have 835 animals from 25 herds enrolled in a prospective study. Animals are being followed serologically from three-to-four months until 15 months of age. Although PI animals, which are thought as the most important source of BVDV infection, have been detected so far in only one of the 25 herds, animals of nine of the 25 herds have BVDV antibody titers consistent with active BVDV transmission in the herd. We anticipate that our findings will help to elucidate herd and animal factors that may be influencing the spread of BVDV in the herds and delineate more effective control strategies.

- b. Impact - This study aims to determine the factors that influence the transmission of BVDV in the cattle herd. In addition, we are evaluating the efficacy of different vaccination protocols. The findings in this study should be a major benefit to the management of BVDV in cattle herds.
- c. Source of Funding – Animal Health and Disease, State
- d. Scope of Impact – Illinois

Swine Nutrition and Bacterial Populations in the Gut

- a. We have shown that the protein threonine is more limiting than valine in a corn-soy diet for lactating sows that are losing considerable body protein. A similar study of lactating sows losing only a moderate amount of body protein is underway. In research on dietary effects on the environment and microbial ecology of the digestive tract, we have made extensive preparations for both laboratory research and experiments on a commercial farm and have generated outside fundings to support this research. We are now verifying our sampling and measurement methods. We have made extensive progress on a meta-analysis of the performance effects of a mannan oligosaccharide product, which is thought to influence the microbial populations in the intestine.
- b. Impact - Our research on amino acid nutrition of lactating sows will help the swine industry reduce nitrogen excretion to the environment, and either reduce lactation diet cost or improve the milk production of sows (weaning weight of the litter). Our other studies will help the industry reduce antibiotic use while maintaining the growth rate and efficiency of feed use. A reduction in antibiotic use may help to control the prevalence of antibiotic resistance in human medicine.
- c. Source of Funding – Hatch, State
- d. Scope of Impact – National

Roles of TNFAlpha and PPARGamma in Enhanced Loss of Body Fat During Periparturient Disease in Dairy Cows

- a. We are working to develop real-time polymerase chain reaction (RT-PCR) procedures to quantify the mRNA for PPARg and TNFa isolated from adipose tissue from over-conditioned and under-

conditioned cows. We also are working to create a probe for leptin mRNA to use in the same samples.

- b. Impact - We expect that our data will allow us to better understand changes in fat cows versus thin cows, which have important implications for management of these cows during the transition from pregnancy to lactation. This basic knowledge should lead to more profitable and healthier cows.
- c. Source of Funding – State, Animal Health and Disease Funds
- d. Scope of Impact – National

Minimizing the Effects of PRRSV Infection in Nursery Pigs With Antioxidants

- a. An ongoing study is investigating if dietary supplementation with a high level of vitamin E reduces the severity and duration of systemic illness after infection with porcine respiratory syndrome virus (PRRSV). Nursery pigs are being fed a basal diet containing the NRC-recommended level of vitamin E (11 IU/kg) or a basal diet containing 500 IU/kg vitamin E from 3 to 6-weeks of age. At 6 weeks of age pigs are inoculated with PRRSV or sterile culture medium. Thus the four treatments comprise the 2 x 2 factorial combination of vitamin E (normal or high) and PRRSV (+ or -). Growth performance and a number of immunophysiological factors are being measured. One trial was completed last year and second trial is ongoing.
- b. Impact - Respiratory infections increase inflammatory cytokines and markedly depress growth in animals. Antioxidant vitamins have been shown to inhibit production of certain cytokines in pigs, and in rodents, antioxidants have been shown to promote recovery from influenza infection. The results of this study will determine if vitamin E facilitates the pig's ability to contend with PRRSV so that the effect of this pathogen on health and productivity is reduced.
- c. Source of Funding – State, Animal Health and Disease, Public Health Service Funds
- d. Scope of Impact – National

Key Theme – Animal Production Efficiency

Estimation of Genetic Effects on Longitudinal and Time-To-Event Livestock Data

- a. Early loss of sows from the herd due to mortality, health problems and poor performance is a major bottleneck in the swine industry. This situation raises animal welfare and economic concerns due to lower productivity, replacement and veterinary treatment costs. Sow longevity is an important aspect of the economic efficiency in swine production units. However, sow lifetime production has been typically overlooked as a selection criterion in preference to litter size and piglet growth.

First, a comprehensive study of sow longevity and production determinants and their interplay was conducted. Over 17,000 sow-parity longevity and production records between 1993 and 2001 were studied. Complementary indicators of longevity including the parity and age, total number and weight of piglets (born alive, weaned) at removal or death were evaluated. Survival analysis, in the form of a linear proportional hazards model, was applied to the different measures of sow longevity. Sow productivity indicators across parities were analyzed using a repeated measurement model. The explanatory variables included parity, age, year, genetic line, and sow-specific removal reasons. A sow had an 81% probability to remain in the herd until the end of the first parity and this probability dropped to 50% after the fourth parity. Reproductive failure was the major removal cause in the first two parities. The probability of a sow remaining in the herd until the first parity was 88% when only reproduction failure was considered. Health, death and locomotion problems were critical limiting factors of sow longevity in the later parities. Genetic line was a significant factor contributing to sow longevity. Assuming 2.35 parities per year and four parities to cover the replacement cost, the difference in the probability of survival to 620 days between the two most extreme genetic lines was 45%. Year and month of farrowing, parity and genetic line have significant effects on litter size. The ranking of the genetic lines in terms of longevity probability did not entirely correspond to that based on productivity.

Second, the indirect response in longevity to traditional selection practices was studied using survival analysis. Longevity records from 43,789 sows across six commercial herds during 11 or more

years (2.2 parities per year) were studied. The average number of parities was 3.5 (SD 2.5) and average longevity was 154 (SD 37) days. Sow longevity was significantly influenced by genetic line and farm. The hazard of removal from the herd was fairly constant by year of first farrowing. An increase in sow survival during the final years of the study indicated a positive correlation with the selected traits.

- b. Impact - In the multi-billion dollar U.S. swine industry, the purchase of out-of-farm replacement gilts constitutes a major budget decision. Ideally, the purchased females will remain in the breeding herd until the investment is recuperated. In practice, forty-to-fifty percent of the sows are removed before three-to-four parities when most replacements break even. Results from our study of sow longevity suggest that culling policies together with the genetic line must be considered in sow longevity and productivity improvement programs.

Estimates of genetic variability indicate that the inclusion of sow longevity in breeding goals will result in further improvements. Breeding objectives, impact on profitability and further understanding of the genetic relationships between traits must be integrated when evaluating the potential response to long-term selection of production and longevity traits in a commercial setting. The resulting characterization of sow longevity can be used to identify bottlenecks and improve the productivity, economic efficiency and well-being of sow breeding herds.

- c. Source of Funding – Hatch, State, USDA Grant Funds
- d. Scope of Impact – National

Swine Semen Evaluation Workshops

- a. Producing high quality pork products for consumers depends upon the transfer of genes from superior boars. The primary limitation to this transfer is efficient and affordable access to these types of genetics. Artificial insemination (AI) provides the mechanism by which these traits can be transferred to distant production systems. In the last ten years, explosive growth in the use of AI has occurred. In 1993, only four percent of operations utilized this technology, compared to more than 70% of farms today.

One of the changes that occurred in this time frame was the shift from genetic progress originating from boars that were purchased and maintained on-farm, to the purchase of semen from a gene supply center. Initially, producers purchased the best boars they could afford and incorporated the genes from that boar into the herd. This rate of genetic progress was slow and very expensive. Later, gene delivery centers, or boar studs, began to appear. These operations allowed for the genes of superior boars to be collected and distributed efficiently and economically to any pork operations that could utilize the technology. In 1999, there were an estimated 20,000 boars in stud located in one of 200 boar studs in the USA. This small but important group was now supplying the genes for 70% of the 6.5 million sows in the USA used to produce pork. It is clear that the success of the modern pork industry relies on the quality and efficiency of semen production by the studs. The value of the semen product to the stud and to the sow farms depends upon the quality of the product. To produce a high fertility product cost effectively requires knowledge of the animal's anatomy and physiology, the industry and product use and technical details of product production.

University of Illinois Extension has helped to provide guidance to this critical segment of the pork industry by offering programs directed toward boar stud management and training in semen evaluation. From 1999 to the present, three advanced semen workshops and a national boar stud management conference have been conducted. These projects have assembled world class experts on the management of boar studs and laboratory semen evaluation. The programs have provided a foundational knowledge of animal management and product production and quality control. The attendees in these programs have represented management and technical persons from boar studs and farms from Illinois, most parts of the USA, Canada, Mexico, and from as far away as Europe and Australia. These conferences attracted over 200 attendees while the semen workshops have had 150 attendees.

Over half of all the boars (10,000) in stud and more than half of all sows mated by AI in the USA (>3 million sows) have been represented at these conferences and workshops. The training and management skills offered has continued to improve boar management, increased production and improved quality of product. This has in turn increased the performance and sows inseminated with these products.

Our partners in this program have been Purdue University, University of Missouri, University of Nebraska, Illinois Pork Producers Association, Minitube of America, IMV International, Continental Plastics, and Kubus.

- b. Impact - One indication of this is the USDA report that indicates that litter size is improved in sows mated with AI when compared to natural service. This increased production efficiency allows superior genetics to reach the farm for production pork desired by consumers at costs that allow pork production operations to maintain economic viability.
- c. Source of Funds – Federal, State
- d. Scope of Impact - National

Germ Cell and Embryo Development and Manipulation for the Improvement of Livestock

- a. This study was designed to determine whether the presence of the bovine alpha-lactalbumin transgene in first-lactation gilts enhances lactational performance and litter growth. Transgenic and sibling nontransgenic gilts were bred to nontransgenic boars. Litters were standardized to 10 piglets within 24 hours of farrowing. Milk production was measured by the weigh-suckle-weigh method on days three, six, nine, and 12 of lactation. Bovine alpha-lactalbumin was present in the colostrum and milk of transgenic gilts throughout lactation. The expression of the transgene was associated with alterations in composition of mammary secretions, especially in early lactation. Lactose concentrations were greater (P 0.05) in mammary secretions of transgenic gilts during the first 12 hours postpartum compared with controls.

In contrast, total solids concentration in mammary secretions from transgenic gilts was lower relative to controls during the first six hours postpartum. Transgenic gilts produced more milk than controls on days three, six and nine of lactation (P 0.01). By day 12, differences in milk production between transgenic and control sows were no longer different. Lactose intake by transgenic-reared litters was greater than lactose intake by control-reared litters on day six of lactation (P 0.05). Total solids intake was significantly greater (P 0.05) by transgenic-reared litters on days three and six compared to control-reared litters.

The day by genotype interaction on litter weight gain after birth was highly significant (P 0.011). Transgenic-reared litters gained weight at a greater rate than control-reared piglets. Expression of the transgene was associated with increased milk production in lactating gilts and increased growth of transgenic-reared piglets. Increased lactose synthesis in response to the presence of the transgene may result in increased milk production in early lactation, leading to increased milk component intake by transgenic litters, and ultimately to increased growth of litters reared by first-parity transgenic gilts.

- b. Impact - Transgenic pig results suggest that α -lactalbumin may be limiting for lactose synthesis, and lactose may be limiting for milk production. Results suggest that over-expressing α -lactalbumin will provide an avenue to increase milk production. This may be useful in beef and dairy cattle as well as sheep, goats and pigs. The production of the α -lactalbumin transgenic swine have and will continue to allow analysis of the effects of over expression of α -lactalbumin on milk composition, milk yield and lactose synthase activity.
- c. Source of Funding – Hatch, State, Multi-State Research Funds
- d. Scope of Impact - AR, CA-D, CO, CTH, IA, IL, LA, OR, UT, WA, WI

Biophysical Models for Poultry Production Systems

- a. An experiment was designed to determine if frequency of liquid aluminum sulfate application to laying hen manure influenced NH_3 production. Treatments consisted of; 1) Control - manure was sprayed on alternate days with 25 ml per square foot of deionized-distilled water; 2) Two-day-manure was sprayed on alternate days with 25 ml per square foot of 48% aluminum sulfate; and 3) Four-day-manure was sprayed every fourth day with 50 ml/ft² of the 48% aluminum sulfate. Mass generation rate of gaseous NH_3 from laying hen manure was reduced by liquid spray application of aluminum sulfate. Magnitude of NH_3 emission reduction was less as time between spray application and emission analysis (lag time) increased.

Regardless of aluminum sulfate spray application frequency or volume, there was a lag time influence. A study was conducted to determine the long-term post-molt effect of feeding several

different diets to induce a molt in comparison to a conventional feed removal program. Post-molt egg production of commercial laying hens fed diets of wheat middlings, a 3:1 wheat middlings - corn combination, or a corn gluten feed was comparable to a traditional feed removal molting technique. Using these three continuous feeding methods to induce a molt did not negatively affect egg shell quality at the end of the post-molt egg production period. Although economic comparisons are subject to many variables, a molting program that utilizes the feeding of a wheat middlings, or wheat middlings-corn combination, or corn gluten feed are alternatives to conventional feed withdrawal molt programs.

- b. Impact - Liquid spray application of 48% standard liquid aluminum sulfate on the surface of accumulating laying hen manure at two and four-day intervals reduced mass emissions of gaseous ammonia. As time interval increased between applications of the aluminum sulfate, effectiveness in reducing ammonia emission decreased. Manure pH was directly related to ammonia emission and followed the same treatment pattern as mass generation rate.

These data indicate that manure pH may be cause/effect-related to ammonia production and release from manure and could possibly be used to not only reduce gas production but also influence the usefulness of the manure as a soil fertilizer. If the commercial egg industry is forced by animal rights/welfare pressures to move towards using molting programs which utilize a non-feed removal method, then feeding a wheat middlings/corn-wheat middlings combination, corn gluten feed, or possibly other types of low energy diets to induce a molt might be considered.

- c. Source of Funding – Hatch, State, Multistate Research Funds
- d. Scope of Impact - CTS, IA, IL, MD, MI, MN, NE, PA, TX

Regulation of Nutrient Use in Food Producing Animals

- a. Environmental cues are used by animals to influence physiologic control of growth, lactation and reproduction. One of the most consistent and highly adapted cues is the annual cycle of photoperiod. Thus, appropriate manipulation of photoperiod can be used to improve animal productivity. Previously we have shown that photoperiod manipulation, specifically long days, increases

milk production in lactating cattle. Shifts in the absolute duration of light exposure an animal receives during a day influences a number of hormonal systems, and it is those hormonal changes that drive differences in lactation.

My laboratory was the first to determine that a known galactopoietic hormone, specifically insulin-like growth factor-I (IGF-I), increased in lactating cows exposed to long days. The working hypothesis derived from previous studies is that long days affect growth and lactation in cattle by altering the transduction of the hormonal signal that stimulates IGF-I, namely growth hormone (GH). Because we also have evidence that GH secretion itself is unaffected by long days, we focused these experiments on GH signal reception at the liver and the effect of photoperiod on IGF-I clearance.

Compared with short days, exposure to long days increased circulating concentrations of IGF-I. GH receptor mRNA expression, an index of the capacity of the liver to transduce GH signal, was correlated with the relative concentration of IGF-I in circulation. However, long day photoperiod had no effect on hepatic GH receptor mRNA expression relative to short days. In contrast, long days increased the abundance of a specific IGF-I binding protein, IGF-BP-3, relative to short days. These data suggest that long days act to alter IGF-I clearance rather than affecting GH signal transduction.

- b. Impact - Understanding of the endocrine basis for the observed response to photoperiod in cows allows for prediction of new approaches to manipulate the efficiency of nutrient utilization via non-invasive techniques.
- c. Source of Funding – Hatch, State, Multi-State Research Funds
- d. Scope of Impact - CTH, IL, MD, ME, MN, NJ, NYC, PA, VT

Illinois TRAILL WWW Site

- a. Illinois Technology and Research: Allied and Integrated for Livestock Linkages (TRAILL) at <http://il-traill.outreach.uiuc.edu> is Illinois livestock producers "one-stop website" for information on a variety of species and topics. TRAILL is a unique blend of multiple colleges, departments and field staff personnel that brings together all University of Illinois research in the livestock area and

makes it available to the public. The project cuts across the disciplinary boundaries, bringing together information in agricultural engineering, animal health and crop sciences with other livestock-related topics. Clientele benefit from the availability of research-based information and online livestock experts.

The Illinois TRAILL project has developed a centralized location for citizens with animal agriculture interest to gather information. Valuable research findings from regional universities is centrally available to livestock producers, allied professionals, regulators, and legislators. From training modules to livestock regulations, the site provides the most up-to-date source of livestock information. The project is a coordinated effort between universities, Extension services and the livestock industry to provide training, research, technical support, and concurrent information. This project entails interdisciplinary partnerships and inter-institutional collaboration between animal agriculture researchers and Educators at Illinois State University, Southern Illinois University, Illinois Coalition for Animal Agriculture, and the University of Illinois Division of Extramural Programs, College of ACES and College of Veterinary Medicine. The Illinois livestock industry gains a competitive and sustainable advantage as information is delivered in a timely and current fashion.

Sites by species include: **Beefnet, Dairynet, Horsenet, Porknet, Poultrynet, and Sheepnet.**

Other sites include:

Illini PEAQ (Predictive Equation Alfalfa Quality)

SOWM (Swine Odor and Waste Management)

Biosecurity and Livestock Diseases - This website of reference materials was prompted by numerous calls regarding Foot-and-Mouth Disease (FMD), Bovine Spongiform Encephalopathy (BSE) and biosecurity.

Photoperiod - This site addresses dairy management options to increase efficiency of the lactating cow. It includes research about photoperiod that has been conducted at the University of Illinois, examples of photoperiod barns, and information on installation and total production cost.

PastureNet - Designed to compile the most up-to-date forage and grazing information by University of Illinois Extension. This site contains proceedings papers from forage and grazing conferences,

field day events, calendars, and presentations by Extension Specialists and Educators.

CLMT - The goal of our CLM training is to educate Illinois livestock producers about waste management practices, rules and regulations to enable them to become certified as required by State of Illinois regulations.

The future of IL TRAILL will be for the project to become self-sustaining by:

1. Collaborating on grants, such as the recently funded Soy-Swine CFAR Sentinel Project. IL TRAILL is funded for \$100,000 over the next four years.
2. Sales of educational CD ROMs produced by IL TRAILL. This has generated \$90,000 over the last three years.
3. Contractual programs have been secured from Monsanto (\$14,100) and Diamond V Mills (\$5,000) and IL TRAILL will continue to obtain industry support.

b. Impact –

Table 1. Summary of WebTrends for all of the SpeciesNet sites (Nov. 2002 to Apr. 2003)

Hits	Entire Site (Successful)	108,277
	Average per Day	719
	Home Page	15,215
Page Views	Page Views	85,386
	Average per Day	566
	Average per Unique Visitor	19
	Document Views	26,696
Visits	Visits	53,312
	Average per Day	352
	Visits from Spiders	7,174
Visitors	Unique Visitors	26,733
	Visitors Who Visited Once	22,749
	Visitors Who Visited More Than Once	3,984

The IL TRAILL project is a centralized location for citizens with animal agriculture interest to gather information. They receive timely and pertinent information, summaries of recent University research, access to experts on demand, notification of local/national meetings, and access to online training modules.

One of the greatest benefits from the IL TRAILL websites is the ability to obtain critical information in a timely fashion allowing livestock producers and industry personnel to make informed management decisions. For example, IL TRAILL responded to the outbreak of Hoof and Mouth Disease in the United Kingdom with a website on biosecurity so that the livestock industry could make informed decisions on the biosecurity needed at their locations. Other benefits of the project include improvement in water quality and odor reduction (swine odor and manure management), forage quality (IL PEAQ) and improved sustainability of livestock enterprises (dairy, swine, sheep, poultry, and beefnet). Consumers and producers benefit from lower costs of production and food, improved food safety and desirable changes in the environment.

- c. Source of Funding – Federal, State
- d. Scope of Impact - International

Key Theme – Animal Genomics

Physiological Mechanisms Involved in Regulation of the Immune System

- a. The most costly economic losses in the animal industry occur when animals fail to grow optimally, as may occur during infections or other stressful living conditions. Activation of the immune system by infectious agents leads to the production of proinflammatory cytokines, such as tumor necrosis factor α (TNF α) and interleukin-1 (IL-1). These proinflammatory cytokines are the major reason why immunologically- challenged animals fail to grow.

Antibiotics added to the Livestock Feeds Act, in part, by reducing activation of the immune system. We have developed a new approach to understanding how proinflammatory cytokines from an activated immune system reduce animal growth and productivity. Insulin-like growth factor (IGF-I) is a small peptide that controls 35% of postnatal animal growth. Eighty three percent of postnatal growth can be accounted for by IGF-I, growth hormone (14%) and the interaction of growth hormone with IGF-I (34%). We tested the hypothesis that activation of receptors for proinflammatory cytokines impair the growth hormone/IGF-I axis, as they do for the insulin receptor, which leads to an inability of animal cells to respond to both growth hormone and IGF-I.

Growth hormone and IGF-I act on their target tissues by binding and activating specific receptors. This process is dramatically inhibited by proinflammatory cytokines. For example, proinflammatory cytokines cause resistance of hepatic GH receptors, leading to a significant reduction in plasma IGF-I. Resistance of the IGF-I receptor at target tissues has been shown by TNF α inhibiting the ability of IGF-I to promote protein synthesis in human muscle cells. The mechanism by which proinflammatory cytokines inhibit the activity of IGF-I occurs by cytokine and hormone receptor cross talk on a single cell. This hypothesis is supported by our recent findings that established TNF α as a potent inhibitor of IGF-I receptor signaling in neurons, which leads to the silencing of survival signals (SOSS).

The molecular mechanism by which TNF α impairs sensitivity of the IGF-I receptor is by decreasing the cascade of intracellular events that normally lead to an increase in growth, such as a reduction in protein synthesis in muscle cells. This action of TNF α occurs at very low concentrations of ≤ 1 ng/ml. The biological result of proinflammatory cytokines from an activated immune system is a potent reduction in the activity of IGF-I, thereby leading to reduced postnatal growth. These data support the idea that the reduction in growth and productivity that occurs in diseased animals is the result of cytokine and hormone receptor cross talk, resulting in a decrease in GH-induced hepatic IGF-I synthesis (GH receptor resistance) and a reduction in responsiveness of target tissues to IGF-I stimulation (IGF-I receptor resistance).

- b. Impact - Two hormones, IGF-I and growth hormone, control >80% of postnatal growth. Activation of the immune system significantly impairs the biological activity of both IGF-I and growth hormone. Antibiotics in feed reduce activation of the immune system. This new knowledge about communication signals between the endocrine and immune systems can now be used to develop novel approaches for improving animal growth. This might occur by reducing synthesis of proinflammatory cytokines or by promoting actions of IGF-I and growth hormone in sick animals.
- c. Source of Funding – Hatch, State, Public Health Service Funds
- d. Scope of Impact – National

Gamete Adhesion Molecules in Swine

- a. Fertilization failure and early embryonic death account for major economic losses in animal agriculture. However, we have a very poor understanding of the molecular steps involved in sperm-egg interactions, particularly in agriculturally important animals. The overall goal of this proposal is to characterize binding of porcine egg coat (zona pellucida) proteins to sperm and identify receptors on sperm that bind zona pellucida proteins.

We developed a technique for direct labeling of zona proteins with a bright fluorochrome and allowed the labeled proteins to bind sperm. Using fluorescence microscopy, we measured binding to uncapacitated, capacitated and acrosome-reacted sperm. We found that zona proteins bind primarily to the apical region of acrosome intact sperm. After the acrosome reaction, zona proteins bind to a much larger area of the sperm, the entire acrosomal region. We expect zona receptors involved in primary (acrosome intact) and secondary binding (acrosome reacted sperm) to be located in these discrete regions of sperm.

We found that less than 10% of sperm from the caput epididymis bound zona pellucida proteins. Although it appears less zona protein bound to these sperm, zona pellucida proteins bound to the same location on caput sperm as they did on ejaculated sperm. Zona pellucida protein binding to corpus and cauda epididymal sperm was not different than ejaculated sperm.

We also identified and characterized putative zona pellucida receptor/s on porcine sperm. We have produced two phage display testis cDNA libraries to screen by zona affinity to identify zona pellucida receptors. We have sequenced about 170 genes, including the porcine version of Catsper but the phage display approach yielded many short positively charged peptides. We started a new screening technique, using expression of testis genes in mammalian cells to identify those genes with zona affinity. We determined the site of synthesis and the final cellular location of some candidate porcine zona receptor proteins but none fulfilled the criteria of bona fide zona receptors.

A better fundamental understanding of fertilization is essential to improve fertilization and early development rates. These studies will identify and study the receptors on a species with great agricultural importance.

- b. Impact - Fertilization failure and spontaneous early death of embryos in the uterus account for major economic losses in animal agriculture. However, we have a very poor understanding of how sperm and eggs interact. Our knowledge of the key proteins that allow sperm to bind eggs is particularly deficient in agricultural animals. The purpose of this proposal is to identify the genes encoding proteins on porcine sperm that are important to bind sperm to eggs. One or more of these sperm proteins will also help sperm release enzymes so sperm can penetrate through the egg coat and fertilize the egg.

We have identified the region of sperm that binds the egg coat. We are using a screen to identify proteins that bind the egg coat and we will be certain they are found on sperm. We will test the biological importance of these proteins during fertilization by blocking them. A better fundamental understanding of fertilization is essential to improve fertilization and early development success rates. One may be able to use these results to develop more accurate fertility assays or add supplements to semen from sub-fertile males to improve their fertility. These studies will identify and study sperm proteins that bind the egg coat on swine, a species with great agricultural importance.

- c. Source of Funding – CSREES Grant, Public Health Service, State
- d. Scope of Impact – National

Production of 25,000 Cattle ESTs and Development of a High Resolution Radiation Hybrid Map

- a. In collaboration with TX, a second generation ordered comparative map of the cattle and human genomes was produced using a 5,000 rad whole genome radiation hybrid panel and in silico predictive mapping tools. A total of 720 new markers were added to the published map, bringing the total number of mapped markers to 2,034 with LOD >9. Of these, 1,423 are cattle genes or ESTs with significant (E less than e-5) hits in human UniGene of which 1,179 have GB4 mapping data, 349 are framework microsatellites and 262 are cattle ESTs with no hits against human UniGene.

Most of the newly mapped genes were chosen using the COMPASS software, allowing specific targeting of gaps in the comparative map as well as sparsely populated map intervals. COMPASS II uses UniGene as a target for BLASTN search and the first generation whole-genome comparative map as the basis for prediction of cattle chromosome and RH bin location. COMPASS III, a new tool, uses human genome draft sequence to identify the sequence coordinates of all genes on the human map thus leading to a very precise definition of comparative bins and conserved segments. The large number of genes and ESTs mapped in this study allows for a comprehensive comparison of gene order between the cattle and human genomes. The number of conserved segments and genomic rearrangements is considerably large, but smaller than between human and mouse.

- b. Impact - This new comparative map will facilitate the identification of candidate genes for economically important traits in cattle and other livestock species.
- c. Source of Funding – CSREES Grant Funds
- d. Scope of Impact – National

Livestock Genome Sequencing Initiative

- a. The research results from the Livestock Genome Sequencing Initiative provide the first sequence-based physical and multi-species comparative maps for cattle. The comparative map created has 32% coverage of the cattle genome and one comparatively anchored BAC-end every 217 Kbp of human genome sequence on average. These maps and accompanying BAC resources will

enable robust assembly of the cattle genome sequence. Furthermore, comparatively-anchored BESs provide a powerful tool for evolutionary studies of vertebrate genome organization and an important new resource for positional cloning of genes affecting health and production traits in this agriculturally important species.

- b. Impact - The results will contribute directly to a sequence-ready map of the cattle genome and will provide the cattle genomics community with an enormously powerful resource for identification of genes of economic importance to the dairy and beef industries.
- c. Source of Funding – State, USDA Grant Funds
- d. Scope of Impact – National

Key Theme – Aquaculture

Microbial Ecology of the Salmon Gastrointestinal Tract: A Molecular Approach

- a. Characterization of the microbial diversity of Atlantic salmon and rainbow trout gastrointestinal communities has previously relied on classical culture-based microbiology techniques. The use of molecular techniques to compare the microbial diversity has several distinct advantages over culture-based approaches. Therefore, the microbial community structures in the gastrointestinal tracts of these food fish were analyzed by denaturing gradient gel electrophoresis (DGGE).

The microbial diversity in the gastrointestinal tracts of Atlantic salmon reared in freshwater or seawater and fed standard or high fat diets were compared. In addition, the microbial diversity in the gastrointestinal tracts of Atlantic salmon and rainbow trout were compared. DGGE banding patterns were analyzed and relatedness trees were constructed. The microbial community structure in the gastrointestinal tract of Atlantic salmon acclimated to seawater for one or seven days was compared to Atlantic salmon reared in freshwater. The community structure in the gastrointestinal tract of Atlantic salmon maintained in seawater for one day was similar to the community structure in the gastrointestinal tract of Atlantic salmon kept in freshwater.

However, Atlantic salmon adapted to seawater for seven days exhibited a microbial community structure more similar to Atlantic salmon kept in saltwater than those in freshwater. The similarities observed among these three groups might be due to the short duration of seawater residency. Additional time in seawater (e.g., >2 weeks) might lead to further divergence in the microbial communities. Assay of the microbial community structure of Atlantic salmon fed standard or high fat diets suggested a shift from diversity typical of Atlantic salmon fed a standard diet to a distinct microbial diversity selected by the high fat diet. Finally, distinct relatedness tree clusters indicate that the microbial community structure of the gastrointestinal tracts of independently reared rainbow trout and Atlantic salmon fed the same diets differ markedly.

- b. Impact - This research should improve food fish health and growth by using molecular approaches for following changes in food fish microbial ecology and bacterial community structure. The investigations proposed will provide new methodologies and reagents for rigorous testing of the efficacy of probiotics in fish. Fundamental knowledge of the mechanism of action of probiotics will also be obtained in the course of this research. Development of effective probiotics could dramatically reduce use of and dependence on antibiotics in the aquaculture industry providing benefits to the producer, consumer and environment.
- c. Source of Funding – CSREES Grant Funds
- d. Scope of Impact – National

Key Theme – Biofuels

Evaluation of the Biomass-Derived Alternative Fuels for Off-Road Vehicles

- a. During 2002, both laboratory-based and in-field evaluations of ethanol-diesel blends were conducted. Also a detailed three-dimensional combustion model was developed for in-depth investigation of biodiesel combustion. A 500-hour laboratory-based test was carried out on an International 7.3 L engine, which was run on a blend containing 10% ethanol, 1% additive and 89% low sulfur #2 diesel fuel. The purpose of the test was to evaluate the durability of the engine, with special reference to the

hydraulically-actuated electronically-controlled unit injector (HEUI) system, while operating at rated speed and maximum load.

Engine variables were monitored during the test with the aid of an engine diagnostic system connected to the engine control module. Engine performance tests were conducted at 100-hour intervals and oil samples were collected for analysis. The results showed that engine performance over the 500-hour period was not affected except due to the expected 4% decrease in power caused by the lower energy content of the blend. Based on oil analysis results, no abnormal engine wear occurred that could be attributed to the blend. However, a fuel lift pump failure did occur approximately halfway through the test. This failure was caused by the swelling of nitrile rubber check valve disks.

A visual and dimensional inspection of the engine showed that the engine was in good condition with International engineers observing that the combustion chamber deposits appeared to be less than expected for an engine run for 500 hours on standard #2 diesel fuel. The effect of the blend on elastomeric components in the fuel system and the origin of the deposits should be investigated further. In-field evaluation of the same blend containing 10% ethanol continued in 2002 with side-by-side tests in the spring with two Caterpillar Challenger 95E tractors and two new John Deere 9650 STS combines fitted with tier II emissions-complaint engines in the fall.

The tests continue to demonstrate positive results with ethanol-diesel blends. Fuel usage with the tier II engines showed no differences between the blend and regular diesel, suggesting that the new engine technology could be responding differently to the blend. In the third area of work, a three-dimensional fluid dynamics model for chemically reacting flows was developed for a combustion chamber in the International 7.3 L engine. It was necessary to define first the physical and thermodynamic properties of biodiesel, taking into account the different compositions of fatty acids. Because relatively little data are available for predicting these properties, methods for estimating key properties required in the modeling of fuel spray and atomization, and combustion were investigated. The combustion model was set up so that the parameters of injection timing, injection duration and exhaust gas recirculation could be optimized for biodiesel combustion. The model output confirmed that biodiesel combustion can cause longer ignition delay that requires

an advance in injection timing. Further development of the model is required with special reference to the auto-ignition model.

- b. Impact - Both laboratory and field evaluations of e-diesel provided engine manufacturers with evidence of the effect of ethanol blends on their specific engines. This research also highlighted the potential to introduce e-diesel fuel as a measure to reduce emissions at a time when engine design modifications to achieve future emissions regulations stipulated by EPA may not be sufficient. Results from combustion modeling will help to explain the mechanisms occurring with an oxygenated fuel as compared to traditional hydrocarbon fuels.
- c. Source of Funding – Hatch, State, Department of Defense, Other Non-Federal Funds
- d. Scope of Impact – National

Key Theme – Biotechnology

The Illinois-Missouri Biotechnology Alliance

- a. The broad goal of the Illinois-Missouri Biotechnology Alliance is to strengthen the agriculture and food sectors in the American Midwest, especially the improvement of food safety and quality. The Alliance funds investigator-driven research under two sub-programs, one aimed at enhancing profitability and one focused on economics and consumer acceptance. The Enhanced Profitability Program specifically seeks to identify new and improved uses for crops and materials that can be manufactured from them. The Socioeconomic Research Program seeks to anticipate and understand the economic and social impacts of agricultural biotechnology and capture as many of the benefits as possible for the American agricultural sector. Specific objectives that fall within the above categories are identified annually by the Executive Board, and grants are awarded to individual investigators following peer review of proposals. Research publications and outcomes are reported individually by principal investigators. For additional information on the Illinois-Missouri Biotechnology Alliance please consult our website at www.imba.missouri.edu.
- b. Impact - The Illinois-Missouri Biotechnology Alliance (IMBA) is a joint program of the University of Illinois and the University of

Missouri and is funded by a Congressional Special Grant administered by the United States Department of Agriculture (USDA). The purpose of IMBA is to fund biotechnology research that is an integral part of a Research and Development (R&D) program directed at expanding the volume of profitable businesses in the United States (U.S.) food and agricultural sector. Initially, the IMBA program was limited in scope to corn and soybeans. However, the scope of IMBA interest now encompasses all concepts of these industries including production, processing, marketing, utilization, inputs and support services, as well as economic, social, environmental, and natural resource concerns. The geographical focus of IMBA is Illinois and Missouri along with other Midwestern states having similar crops, soils, climate, and socio-economic conditions.

- c. Source of Funding – CSREES Grant Funds
- d. Scope of Impact – Illinois and Missouri

Soybean Gene Expression and Regulation

- a. The objective of this research is to understand the regulation of gene expression in soybean as revealed by examination of unusual mutations in genes that affect pigmentation of the seed coat. One of these genes shows a form of gene silencing, another affects both pigmentation and cell wall structure, and others contain mutable alleles that may be due to transposable elements. Work in progress includes development of quantitative RT-PCR for the CHS gene family and using it to determine the differential expression of the CHS genes in mutations of the I locus, and isolating other genes involved in the flavonoid pathway in soybean.
- b. Impact - This research will benefit the biotechnology industry and soybean producers and consumers by providing basic information on gene regulation in soybean, specifically on the mechanism of gene silencing. This information will be applicable to designing better vectors for genetic transformation that will overcome the problem of gene silencing in transgenic plants. The information on the CHS gene family may allow the regulation of the flavonoid pathway for plant disease resistance or the modification of flavonoid products in the seed for improved nutritional and health value.
- c. Source of Funding – Hatch, National Science Foundation, State

- d. Scope of Impact – National

Diversity in the Hierarchical Regulatory Cascade That Controls TI Plasmid Conjugal Transfer

- a. The objective of this research is to determine the molecular basis of gene transfer in plant-associated crown gall bacteria. Ti plasmid conjugal transfer is controlled by a hierarchy of signals. Opines, produced by the crown gall tumors induced by *Agrobacterium tumefaciens*, induce expression of a quorum-sensing system that directly regulates conjugation in response to a signal, the quorumone, produce by the bacteria themselves. Opines control conjugation by regulating the expression of *traR*, the quorum-sensing activator responsible for transcribing the *tra* regulon. We found that in each case opines control transfer because *traR* is a member of an operon the expression of which is regulated by the conjugal opine.

In our studies on the diversity of the systems among Ti plasmids activated by different opines we identified three independent associations of *traR* with different opine-regulated gene sets. In two additional cases we have identified a conjugal opine system, the agrocinoines, undergoing evolution to yield at least two non-interacting regulatory systems. We have extended our findings to non-Ti plasmids where we showed that transfer of an opine catabolic plasmid that is controlled by two opines results from having two copies of *traR* each regulated by a different opine. We recently began research on a set of plasmids in which transfer is controlled by the mannityl opines, a family not previously known to regulate conjugation. Studies to date suggest that in these plasmids mannopine regulates the expression of the quorum-sensing system.

- b. Impact - Our research represents an investigation into mechanisms by which genes are transferred from one bacterium to another in the environment. Our studies show that a complex signaling system controls transfer of *Agrobacterium* Ti and opine-catabolic plasmids and that this system has arisen by several independent sets of gene fusions all designed to place the expression of *traR* under the control of a particular opine. The results indicate that opines are an extremely important component of the biology of *Agrobacterium* plasmids, and of the bacterial hosts themselves.
- c. Source of Funding – Hatch, State, Public Health Service Funds

- d. Scope of Impact – National

Key Theme – Diversified/Alternative Agriculture

**Outreach Program in the
Amish Communities in East Central Illinois**

- a. Approximately 650 Amish families live in East Central Illinois. Amish growers produce vegetables, fruit and ornamentals. Two of the main issues facing Amish growers are management and marketing of crops. To overcome the Amish avoidance of new technology, a special Extension project was funded. Dr. Mohammad Babadoost made the following efforts: 1) he established a series of contact opportunities, 2) initiated an approach for rapid diagnosis and management of crop problems, and 3) helped to improve the established cooperative marketing system. In January 2003, a workshop was conducted on March 22, 2003 for this purpose of development of a cooperative marketing system.

In order to enhance knowledge of crop production in the Amish community, some useful publications have been provided to Amish growers and a small library is being assembled in their Co-op Center. Utilization of this program significantly improved production and marketing of crops and changed the quality of life for many Amish families and Amish communities. Amish growers have already planned to establish a big auction center for their produce, which will be in operation beginning 2004.

- b. Impact – Formation of a cooperative involving 20 different vegetable growers (Arthur Area Produce.) Development of greenhouses and other support to produce vegetable crops and flowers.
- c. Source of Funding – Federal, State, Local
- d. Scope of Impact - Illinois

**The Influence of Corn and Soybean Phenology on Western
Corn Rootworm Densities**

- a. Analysis of data from on-farm experiments revealed that western corn rootworms exploit both corn and soybean fields for egg-laying purposes in east central Illinois. Absolute estimates of eggs

were 1.7, 3.8, and 3.1 million per hectare for three cornfields planted on April 20, 16, and 20, respectively, during 2001. Seasonal totals of eggs in adjacent soybean fields were 3.4, 5.8, and 4.0 million per hectare with planting dates of May 16, 3, and 1, respectively, during 2001. These data document that western corn rootworms have expanded their ovipositional range of crops; however, they have not abandoned corn as a suitable egg-laying site.

Because of the ovipositional acceptability of soybean fields in east central Illinois, the rotation of corn and soybean no longer serves as an effective cultural management tactic for producers within this area of Illinois. Consequently, many producers now spend approximately \$15 per acre for a soil insecticide applied during planting. We have not detected western corn rootworm eggs in soybean plots in our phenological experiment located in northwestern Illinois. Therefore, producers in northwestern Illinois are encouraged to continue their reliance upon crop rotation as an effective pest management tactic. Other ovipositional experiments indicated that western corn rootworms in east central Illinois will lay eggs in other crops such as alfalfa and even oat stubble. Egg samples collected in plots near Champaign, Illinois revealed 9.9, 8.1, 7.2, and 3.4 million eggs per hectare in corn, soybean, oat stubble, and alfalfa treatments.

- b. Impact - These experiments indicate that longer-term rotational strategies and the establishment of a more diverse agricultural landscape will be required to thwart western corn rootworms that have expanded their range of crops that are suitable for egg-laying. Unless the reliance on a corn and soybean rotation is shifted, producers will continue to rely upon soil insecticides for corn rootworm control. Interest in the potential registration of transgenic corn rootworm hybrids also is increasing among farmers. An over-reliance upon transgenic hybrids for corn rootworm control, similar to the overuse of soil insecticides, may hasten the development of resistance. Our experiments illustrate the importance of diversifying the agricultural landscape to avoid the future development of new pest management challenges.
- c. Source of Funding – Hatch, State
- d. Scope of Impact – Illinois

Key Theme – Emerging Infectious Diseases

Biology and Management of Selected Soilborne Pathogens on Field Crops

- a. The goal of this research is to develop information on the biology and management of selected fungal pathogens of major crops in Illinois. The objectives are to characterize the population structure of several pathogens in Illinois, with emphasis on *Phytophthora sojae* and *Aphanomyces euteiches*, and evaluate various tactics, including resistant cultivars and biological and chemical seed treatments, to manage these pathogens. Soil samples from soybean and alfalfa fields were collected from fields representing all regions of Illinois. Isolates of *Phytophthora sojae* were obtained from many of the soybean fields, and isolates of *Aphanomyces euteiches* were obtained from numerous alfalfa fields. Isolates from other locations in the U.S. were also collected for comparison and testing.

We are in the process of evaluating pathogenicity, virulence, race, and sensitivity to selected fungicidal compounds for these pathogens in laboratory, greenhouse and field experiments. Preliminary experiments are also in progress to develop and test molecular biology (PCR) methods for characterization and diagnosis of these and other soilborne pathogens in Illinois. Various seed treatment fungicides and biological control products are being tested for disease control of *Phytophthora* and other seedling diseases in field trials. A range of different virulence phenotypes of *P. sojae* were identified from soybean fields in Illinois. Soybean *Rps* genes 1c and 1k appear to be effective against most populations of *P. sojae* in Illinois; however, populations have been identified that overcome 1c and 1k. Isolates of *Aphanomyces euteiches* have been identified from over 90% of the alfalfa fields tested in Illinois, which indicates that this damaging pathogen is widespread in the state.

Preliminary results from tests of soybean seed treatments indicate that some seed treatments improve stands, especially in no-till fields, but yield increases are often not correlated with increases in stand.

- b. Impact - Soybean and alfalfa are the two major legume crops in Illinois, with combined total acreage just over 4.453 million ha. This research is focused on improving disease management practices for two important diseases of these crops, *Phytophthora* rot of soybean and *Aphanomyces* root rot of alfalfa. This research

will provide information concerning the races of *P. sojae* in Illinois as well as deployment of the resistance genes that are available in Illinois soybean varieties.

Soybean fungicidal seed treatments have the potential to be another effective tool to manage Phytophthora rot and other soybean seedling diseases, and we are producing data based on field experiments that producers can use to determine if seed treatments can provide significant benefits. Aphanomyces root rot seriously affects establishment and growth of alfalfa and reduces alfalfa yields, and we are developing information about the distribution, races and best management tactics for this disease in Illinois.

- c. Source of Funding – Hatch, State, Industry Funds
- d. Scope of Impact – Illinois

Key Theme – GIS/GPS

Automatic Guidance System Provides Needed Labor and Necessary Relief

- a. Recent advances in precision farming, agricultural machinery and information Technologies have enabled many farmers to manage their fields site-specifically. Precision farming can give the farmer an economic and environmental advantage, but it also requires more on-the-go management decisions and can add to the stress of the extended, labor-intensive work levels many farmers experience. In addition, the farm labor force is shrinking (there are fewer family farms and fewer people willing to stay on the farm) and aging (60 percent of all farmers are over the age of 60). It is increasingly difficult to find experienced drivers, and the aging agricultural worker finds it difficult to work all day because of the tedious and laborious tasks.

Researchers at the University of Illinois have developed an automatic guidance system that can pilot a tractor or combine through a field. An advanced steering control system drives the machine automatically, while a Global Positioning System (GPS) sensor determines the tractor's precise location in the field, a video camera scans the immediate surroundings and other sensors determine the tractor's motion and calculate its path.

This technology has been successfully tested on six vehicles. One of these tractors has driven itself for several seasons, both day and night, doing planting and cultivation at normal operating speeds.

- b. Impact - Because automatic guidance can drive a tractor across a field precisely, it eliminates the likelihood of gaps or overlaps when planting seed or applying chemicals. Free from the task of driving, operators will be able to focus on other on-the-spot decisions and monitor any precision ag equipment they might have. Automatic guidance will also help fulfill the labor requirement, as well as reduce farmers' fatigue. This will in turn lead to increased safety and productivity.
- c. Source of Funding – Federal, State
- d. Scope of Impact – National

Key Theme – Grazing

Intensive Pasture Development Workshops

- a. Intensive grazing is a technique for getting increased utilization of forage and better production out of animals. A properly managed pasture system will provide adequate, high-quality forage for animals for a longer period during the season. The principle of intensive grazing is to allow the grasses to grow to 8 to 12 inches in height. Then, turn animals into a paddock to graze the forage back to about three-to-five inches in a short period of time, usually three-to-six days. After grazing, the animals are removed, giving the forage a rest period to regrow. This encourages the grass to remain on a vegetative state growing vigorously and thicker.

From an environmental standpoint, the grazing rotation maintains a better vegetation cover through active planting, which helps prevent erosion. It's a sustainable system that can easily provide continual food for livestock ten-to-eleven months out of the year, therefore, less supplementary feed is needed.

To help producers utilize this sustainable system of agriculture, U of I Extension has held a number of educational activities such as pasture walks and workshops.

During the summer of 2004, a survey of participants in three such workshops was conducted. Of the 79 participants contacted, 59

percent responded to the mail questionnaire. Participants reported beef, dairy, sheep, horses, and goats as being typical of their livestock operations. Forty-one participants indicated an 2003 average pasture acreage of 83 acres while 40 reported a 2002 average of 105 acres.

For 2003, there was an average of 74 acres in pasture or grazing. Two-thirds reported having attended other U of I Extension grazing programs suggesting a continued interest in both the topics and U of I Extension as an information source.

More than 95 percent of the participants felt the workshops provided practical information, was worth their time and effort and would recommend the workshop to others. Forty-eight percent strongly agreed information from the workshop would help increase profits; 43 percent agreed and nine percent indicated they "didn't know."

Less than six months after the workshops, more than 30 percent of those responding reported implementing one-to-six recommended practices as a result of the workshop. A total of 77 percent of those responding planned to implement an average of three practices.

During the past four years, more than 60 grazing workshops have been held in Illinois with more than 1,800 attending. One multi-state conference drew an audience of 320.

- b. Impact – Projecting the finding from the 2003 survey covering multiple workshops, over the past four years:
- At least 640 would have implemented practice changes within six months of attending the workshops. More than twice as many would have developed intentions to change during that same six-month period. A longer term study would be needed to determine what additional practice changes would have been implemented based on these intentions.
 - If one accepts the assumption that those attending the multi-state conference adopted practice changes at the same rate indicated by the workshop surveys, at least an additional 96 persons would have adopted at least one practice change within six months of the conference.

- c. Sources of Funding – Federal, State, Local
- d. Scope of impact – Multi-State

Key Theme – Home Lawn and Gardening

4-Seasons Teleconference Series

- a. Homeowners garden for several reasons, including enhanced beauty of property, food production, therapeutic effect, recreation, enhanced value of property, controlling chemical use in their own personal environment, exercise, saving money, and energy conservation.

Gardening is the number one hobby in the United States and a major source of exercise for many Illinois residents.

To help meet needs of gardeners, U of I Extension has offered a total of 12 different sessions by distance education in 2002 and 2003. A follow-up mail survey was conducted with 231 folks who registered for one or more of the sessions offered during the summer of 2003. These sessions included landscape maintenance, rose growing and control of pests on perennials.

- b. Impact - Results related to the individual sessions:

66.3 percent were able to do a better job of recognizing perennial pests

48.4 percent were able to achieve better control of rose pests

20.3 percent started a landscape plan (an additional 22.8 percent planned to establish such a plan)

Of those respondents who attended one or more sessions:

- 69.6 percent reduced their use of pesticides
- 67.7 percent reported gardening more due to the sessions indicating a higher level of physical activity (exercise)
- 89.9 percent reported trying new approaches to gardening
- 89.0 percent reported greater satisfaction with the results of their gardening efforts
- 96.7 percent would recommend the teleconference sessions to others
- 87.4 percent reported sharing the information they learned from the session(s) with an average of five other people.

The distance education approach was a major hit with more than 4,275 registrations for each individual session. End-of-meeting comments included:

- “This is an exceptional method of conveying information to many groups simultaneously.”
- “I really like this system; it sure cuts down on long distance travel.”
- “I like this method of teaching; we can get information and yet stay close to home for everyone.”
- “Excellent program as usual of University of Illinois Extension. Neat way to educate many gardeners.”

- c. Source of Funds – Federal, State, Local
- d. Scope of Impact - Illinois

Key Theme – Invasive Species

Development of Pest Management Strategies for Forage Alfalfa Persistence

- a. Alfalfa blotch leafminer (*Agromyza frontella*) (ABLM) is an alfalfa pest that was introduced from Europe. Leafminer larvae feed in the alfalfa leaf, resulting in near-total consumption of leaflets. The leafminer was first introduced into the Eastern U.S. in the 1960's, and was successfully brought under biological control after several parasitic wasps from France were released in the 1970's. Those parasites have kept the leafminer under complete control in the East ever since. Two of the wasps, the braconid, *Dacnusa dryas*, and the eulophid, *Chrysocharis liriomyzae*, were

thought to be the most important control agents. However, the leafminer also found a home in Ontario, Canada, where it remained at low levels until it was accidentally brought into the upper Midwest in the early 1990's.

Once reaching Minnesota and Wisconsin, leafminer populations exploded (up to 100% of plants in some fields were damaged) and the leafminer moved south, reaching Illinois by 1997. Our program in Illinois has been investigating this invasion, to document the presence and spread of the leafminer throughout Illinois, and to help develop recommendations for growers. Because of other potential insect pests in alfalfa, this leafminer is not a good candidate for control with insecticides. Alfalfa weevil and pea aphid are currently kept under biological control by other species of parasitic wasps. Spraying insecticides against the leafminer would likely kill many of these parasites, thus causing worse pest problems. Therefore, it is crucial to inform growers of this consequence of inappropriate use of insecticides, develop alternative solutions and document the presence and effects of the biological control agents.

Sampling efforts in 2002 focused on previously sampled counties in Illinois where ABLM was not detected in 2001 and on alfalfa-producing counties that were not surveyed in 2001. We did not resample counties where ABLM was detected in 2001. Our sampling efforts targeted the adult stages of the second and third generations. Samples were collected within five days of June 13th and within five days of July 25, 2002.

Two randomly selected sites per sampled county were collected. From each site, forty stems were randomly selected, cut at the base and placed in a single brown paper bag. The latitude/longitude of the sample site, the name of the nearest town, and the date the sample was collected was recorded for each sample. Twenty sets of ten sweeps (total of 200 sweeps per plot) were collected at each site and placed into ziploc bag. Samples were kept cool or frozen until processed. We collected 73 samples during the week of June 13th, and recorded two new county records of ABLM infestation. An adult leafminer fly was captured in Woodford County, and a mine was found in Piatt County. Samples from July 25th added four more sites. We have processed the sweep samples from 56 of the 77 sites, and have detected one new county record, as an adult fly was captured in Carroll County. Stem samples are still being processed. Parasitoids were collected either on emergence or via

dissection from flies. Distribution and percent parasitism are being determined.

- b. Impact - We expect to understand the process of invasion by this exotic agricultural pest, and whether biological control agents have followed the leafminer as the pest moves through the state. With this information, we hope to have recommendations for growers that will allow them to manage the pest without using insecticides.
- c. Source of Funding – Multi-State Research Funds
- d. Scope of Impact - IL, IN, KY, MD, MI, MN, MO, NE, NYG, OH, OK, SD, VA, VT, WI, WY

Invasive Species Response Program

- a. Over the past few years, Illinois has experienced several invasive pests (e.g., Asian long-horned beetle, soybean aphid, emerald ash borer, *Ralstonia solanacearum* on geranium, etc.). Clearly, the intentional or unintentional introduction of pests can have serious consequences on the health and economic wellbeing of our citizens, state and nation. Thus, steps have been taken at the national, regional, state, and local levels to address invasive pest species as well as related agricultural biosecurity concerns.

As part of the Homeland Security Response, a USDA National Plant Diagnostic Network was established to augment existing diagnostic resources and networks within each state. The University of Illinois Plant Clinic is part of this network and Director Nancy Pataky participated in many related meetings and workshops. Most recently, Pataky took part in a soybean rust identification workshop held at a USDA containment facility in Fort Detrick, Maryland.

As first detectors and diagnosticians, Extension staff plays a vital role in this network. The time between detection and response is crucial as we attempt to lessen, or prevent, the effects of a new invasive pest. The IPM team has taken several steps to help ensure that University of Illinois Extension campus and field staff understand their role in the diagnostic network. During a joint IPM and Crop Systems team meeting on March 18, 2003, eight speakers (representing Extension, IL Fire Service Institute, IL Natural History Survey, and IL Dept. of Agriculture) presented information relating to “Ag Biosecurity Issues, Field & Hort Crop

Pest Containment and Protocol”. As a follow-up in June, each IPM, Crop Systems, Horticulture, Natural Resource Management, and Animal Systems Extension team member; Extension Unit Leader; and IDA Plant & Pesticide Specialist (Inspector) received a packet from the IPM team which included the following items: 1) Letter of explanation & importance, 2) North Central Plant Diagnostic Network brochure, 3) U of I Extension Specialist contact card (wallet-sized & laminated), 4) “Detection to Education” contact flow chart, and 5) National Pest Alert: Soybean Rust. In addition, an “Invasive Pest Diagnostic Network” awareness display was created for the benefit of all University of Illinois Extension staff during the Annual Extension Conference in October 2003.

- b. Impact - This enhanced diagnostic network is in the early stages of development. Thus, the goal during 2003 was to raise internal awareness of the network. Initial stages are in place. In 2004, the digital components of the network are expected to be installed. Additional awareness training will be needed for both internal and external first responders.
- c. Source of Funds – Federal, State
- d. Scope of Impact – Illinois

Key Theme - Organic Agriculture

Also see Pest Management for Transitioning Organic Vegetable Production Systems under Key Theme - *Plant Production Systems*

Research and Extension Examine Organic Agriculture Issues

- a. A group of researchers based in the College of Agricultural, Consumer and Environmental Sciences at the University of Illinois and the Illinois Natural History Survey, as well as U of I Extension and organic farmers, have banded together to launch a new research initiative examining issues of organic agriculture. Six acres assigned to the Survey and located on the University-owned Cruse Farm have been set aside for the multi-year project. Earlier this year, the group was awarded a sizable research grant from the USDA Organic Transition Program. What is affectionately called the “WORT (Windsor Organic Research Team) Project” it is the largest concerted effort to date by University and survey

researchers to focus squarely on questions related to organic agriculture.

The use of organic farming practices, characterized by the prohibition of chemically-based fertilization and pest control, is increasing. Though some substances are allowed for field application, organic farmers must depend on alternative strategies such as biodiversity, long-term crop rotations, natural predators, and beneficial insects to manage their farms. The methods used vary field by field and require intimate knowledge of soils, crops, pests, and the multiple interactions present in all biological systems. Interest in organic agriculture is growing due to continued increase in the market demand for organically grown food — at 20 to 25% the fastest growing segment of the food industry for the last several years.

The WORT research reflects the obstacles farmers face in adopting organic practices, including the risk of shifting to new farming methods and a lack of readily available science-based information. It compares the influence of transition schemes that differ in management intensity and organic amendments on pests, plant health, soil fertility, soil invertebrates, and their interrelations. Management intensity treatments during the three-year transition period include intensive vegetable production, less intensive cash grain production and grass-legume sod. The project's goal is to establish an organic systems program partnership of organic producers, researchers, and Extension Educators that improve performance of organic systems and enhances farmers' ability to meet the growing demand for organic products.

Links:

<http://www.aces.uiuc.edu/asap/organics/index.html>

<http://www.aces.uiuc.edu/asap/news/v12n3.pdf>

- b. Impact - "WORT (Windsor Organic Research Team) Project" is the largest concerted effort to date by University and survey researchers to focus squarely on questions related to organic agriculture.

Project teams College of ACES researchers, U of I Extension and stakeholders.

- c. Source of Funds - Federal, State

- d. Scope of Impact - National

Key Theme – Ornamental/Green Agriculture

Surveying the Illinois Green Industry to Assess its Value, Attributes and Needs

- a. Dissemination of survey results to the industry and citizens of Illinois was a major and specified goal of the green industry survey. This goal was met in several ways. First, preliminary results were presented to the public through press releases and media briefings at selected locations across the state. Second, the published report was distributed statewide to all green industry associations, all community and four-year colleges and universities with agricultural or horticultural programs, selected Illinois legislators, and by request to interested parties. The report was also sent to all land-grant institutions and agricultural experiment stations throughout the nation. Third, a brochure highlighting the survey's major findings was printed and distributed to survey respondents, high school counselors, field Extension offices and organizations such as the FFA, and at major exhibitions like the Mid-America Horticultural Trade Show in Chicago. And fourth, the survey report and brochure was made available to the public from the NRES website. About 1,400 reports and 10,800 brochures were distributed. Planning is currently underway to solicit support for a series of recurrent statewide surveys to track vital green industry parameters and markets.
- b. Impact - The most significant impact of the survey is a broader recognition of the green industry's importance to the state's economy. Leaders in state government, college and university administrators and the general public are now more aware of how the green industry affects the state economy. This broader recognition has changed the character of discussions and political support for the green industry throughout the state. A secondary impact is that the survey has encouraged the industry to form a statewide coalition of associations.
- c. Source of Funding – Hatch, State
- d. Scope of Impact – Illinois

Key Theme – Plant Germplasm

Comprehensive Resources and Datasets for Mapping Genes Controlling Maize Traits

- a. Modifying corn grain composition to increase the value of the grain has been a long-term objective of corn breeders. However, there is sometimes an associated reduction in grain yield when kernel composition is modified which negatively impacts the economics of the value-added concept. Molecular marker assisted selection of small chromosomal segments or specific alleles of candidate genes has been proposed to address this problem. However, many of the results on kernel composition and grain yield were performed at different times and in different locations.

This research is utilizing several molecular marker-mapping populations already developed for which molecular markers were genotyped, phenotypic data were collected for certain traits and marker trait associations were determined or under analysis. We are continuing to move molecular marker trait data sets on several per se and testcross populations for kernel composition traits, plant morphology traits and disease resistance into specific Excel spreadsheets. We have worked on the ready interface of the prototype Access database with the Excel spreadsheets, so that the data can be easily put into the Access database and also extracted for additional statistical analysis.

We grew more populations this year and collected phenotypic data to more precisely define associations, enable specific comparisons across populations and assess candidate gene ESTs for association with QTL. We obtained more seed and grew the full Mo17xB73 IBM resource population that is part of the NSF Plant Genome funded Missouri Maize Project. This population, designed specifically to serve as the common resource population for integrating corn genetic, QTL, and microarray data for the corn genetics and breeding community, is serving as a core population within our database. We accessed the molecular marker mapping genotypic information for this population and were able to perform QTL analyses for this population for tassel architecture and kernel composition traits. We routinely use a new computer server as a central resource for consolidation and summarization of our data. We have made the server available to a new faculty member, thus beginning the process of making the database more useful to our corn breeding and genetics personnel.

- b. Impact - We wish to increase the value of corn grain through genetic means by integrating, summarizing and making more useful and available information collected on chromosomal regions and candidate genes controlling kernel composition, disease resistance, plant morphology, tassel architecture, and grain yield.
- c. Source of Funding – Hatch, State, National Science Foundation Funds
- d. Scope of Impact – National

Genetic Mapping and Introgression of Yield Genes into Soybeans from Glycine Soja

- a. The goals of this research are to improve soybean yield and widen its genetic variability. These goals are being accomplished through the mapping of genes from *Glycine soja* that control yield and agronomic traits and the testing of the effectiveness of a novel population structure for mapping genes from a wild species. This mapping was done in five backcross populations that were evaluated with genetic markers and in four locations in the field. The recurrent parent used in developing the backcross populations was a U.S. variety and the donor parent was a *G. soja* line.

During the past year, the yield and agronomic data from the experiments were analyzed and a manuscript was prepared describing the results from these mapping efforts. Using a high stringency for accepting significance, we identified four genetic regions containing genes that putatively control yield. All four of these regions were also associated with plant height and two were associated with maturity. This indicates that some of these genes may control yield, at least in part, through a direct effect on other agronomic traits. The allele for greater yield originated from the soybean parent for all four of the mapped yield genes. When the stringency for the significance threshold was relaxed, four putative yield genes were identified where the alleles from the *G. soja* parent were associated with greater yield. These *G. soja* yield genes were tested in new confirmation populations during the summer of 2001. The confirmation populations were developed by crossing plants from the original backcross populations with a second U.S. variety.

During field tests in Chile during the winter of 2000-2001 and in Illinois and Nebraska during 2001, one of the four putative yield

genes was significantly associated with an increase in yield. The genetic region containing the significant yield gene was not associated with other agronomic traits. The population segregating for the significant gene was retested in 2002, and the data from these tests will be analyzed soon. In addition, new isogenic populations were developed that are segregating for this significant *G. soja* yield gene. These populations will be tested in Chile this winter and in the U.S. during the summer of 2003.

- b. Impact - The goal of this research is to improve soybeans through the identification of useful genes from *Glycine soja*, the wild ancestor of soybeans. Soybean populations were developed that have genes from *G. soja* incorporated into them. These populations were evaluated with DNA markers and in field tests for seed yield and other agronomic traits. Many of the lines in the field tests yielded well and have good agronomic appearance. Four alleles from *G. soja* were identified as associated with significantly greater yield. One of these alleles was also found to be significantly associated with greater yield in a second confirmation population. The confirmation population was retested during 2002 in Illinois and Nebraska.

New populations of lines that are nearly genetically identical except for the genetic region surrounding the significant yield gene have been developed. These populations were tested in the field during the winter of 2002-2003 in Chile and in the summer of 2003 in Illinois and Nebraska. The finding of new, yield-improving genes from *G. soja* may help pave the way to improving the productivity of the soybean crop, thus increasing the efficiency of soybean production.

- c. Source of Funding – State, CSREES Grant Funds
- d. Scope of Impact – National

Genetic Manipulation of Sweet Corn Quality and Stress Resistance

- a. In the past 15 years, sweet corn varieties with the *shrunken2* (*sh2*) and *sugary enhancer1* (*se1*) mutations have come to dominate the market share of the fresh market sweet corn industry resulting in the elimination of older non-mutant varieties. Sweet corn kernels with these mutations have approximately double kernel sugar content at fresh harvest making them overwhelmingly preferred by consumers and distributors while improving profitability.

Unfortunately, mature seeds carrying these mutations and used by growers for commercial planting show a reduced percentage of field emergence and lower seedling growth rates particularly in cold spring soils. In order to develop cultural and genetic strategies to overcome this problem, a study was completed that determined what differences in the chemical and physiological properties of sweet corn kernels with the *sh2* and *se1* mutations were associated with reduced emergence and growth under replicated field conditions using two sweet corn (*Zea mays* L.) populations (one carrying *sh2* the other *se1*) varying for these characteristics. In concert, the location and magnitude of effect of genes controlling these field and physiological variables were mapped using 94 and 61 polymorphic DNA markers spaced throughout the chromosomes of these two populations, respectively. The 330 F2:3 families from the two populations were evaluated for seedling emergence and growth rate at four locations while mature-dry kernels of each family were assayed for kernel chemical and physiological variables.

Improved emergence was positively correlated with the reduced kernel solute loss during seed hydration, greater embryo dry weight, and higher kernel starch, lipid and protein content. Analysis of field performance against the marker data identified three major gene loci in each of the two populations that were responsible for differences in emergence. In the *su1 se1* population genomic regions significantly influencing emergence across all four environments were found associated with the *se1* gene on chromosome 2 and the RFLP loci php200020 on chromosome 7 and umc160 on chromosome 8. In the *sh2* population the RFLP loci php200689 on chromosome 1, umc131 on chromosome 2 and bnl9.08 on chromosome 8 were linked to QTL significantly affecting emergence.

The three RFLP loci identified in the *sh2* population associated with enhanced seed emergence were backcrossed three generations into three commercial sweet corn inbreds. Hybrid seed from crosses among these lines displayed significant increases in seed emergence. Hybrids carrying the beneficial allele of the gene linked to *umc131*, *bnl9.08*, or *php200689* displayed increases in seedling emergence of 41%, 30%, and 28%, respectively.

- b. Impact - Identification of the biological basis for poor emergence in *se1* and *sh2* sweet corn provide the basis for technological and genetic solutions for this problem. Our research suggests that development of films with differential permeability that surround the seed, permitting entry of water for the seed germination process but prohibiting diffusion of seed water soluble compounds should increase seedling soil emergence. This study has also identified genes that interact with the *sh2* and *se1* mutations to improve seedling emergence and plant stand establishment. Public and private sweet corn breeding programs have begun to use marker-assisted selection to introduce these desirable genes into elite inbreds to improve hybrid seed quality and field performance. Improvement of seedling emergence in the 30-40% range represents a significant savings to sweet corn growers and will help the seed industry to improve sale of hybrids with these germination-enhancing genes.
- c. Source of Funding – Hatch, State, Multistate Research Funds
- d. Scope of Impact - DE, FL, HI, ID, IL, IN, MN, NYC, NYG, OH, OR, WI

Key Theme – Plant Health

Genetic Variability in *Heterodera Glycines*

- a. A revised system of classification for genetically diverse populations of *Heterodera glycines* (the soybean cyst nematode), called the HG Type test, was proposed and further characterized. Over 300 field populations of *H. glycines* were tested, and the results show that most of the populations are virulent on one or more of the sources of resistance used in public and private soybean breeding programs. This indicates that even the best resistant cultivars are at risk of yield loss due to *H. glycines*. Inbred isolates of *H. glycines* were also tested according to the new protocols, and those that had marked differences in phenotype

(virulence on resistant soybean plant introductions [PI]) were used in Amplification Fragment Length Polymorphism (AFLP) analysis to identify markers associated with virulence on PI 548402 ('Peking'), PI 88788, and PI 437654. These three PI represent the sources of resistance in more than 90% of the *H. glycines*-resistant soybean cultivars available to growers in the Midwest.

In addition, populations of *H. glycines* from Argentina, Canada, China, and Korea were tested for infraspecific variation based on sequence analysis of the internally transcribed spacer regions ITS1 and ITS2. A polymorphism was identified that distinguished the Chinese isolate from all other isolates. Further analysis is continuing. Near-isogenic soybean lines differing for resistance to *H. glycines* were provided by collaborators. Genes for virulence in the nematode are being fixed by classical genetic methods (single-cyst descent and backcrossing) to be used in further molecular studies and as challenge populations for use by soybean geneticists investigating genes for resistance. A collection of over 30 inbred lines is maintained in planta in water baths in a greenhouse. The ultimate goal of this research is to replace the phenotype-based bioassays used for assessment of genetic variation in *H. glycines* with a genotype-based classification system.

- b. Impact - The newly revised system of classification of genetically diverse populations of soybean cyst nematode will impact all soybean breeding and nematology Extension programs wherever the nematode is found. Current applications from basic research to management recommendations are based on the "race" system of population classification. All of these applications will be changed as a result of the new system.
- c. Source of Funding – Hatch, State, Industry Funds
- d. Scope of Impact – National

Determination of the Roles of Secreted Proteins in Root-Knot Nematode Parasitism

- a. The goal of this research is to determine the role of three nematode genes in the life cycle of the root-knot nematode. Each of these genes appeared to encode a secreted protein whose function was essential for the life of the nematode. We had three objectives. The first was to determine the effect of expressing a nematode chorismate mutase (CM) in plant roots. The second was to

determine if a pectate lyase-like protein had enzymatic activity and if the protein was secreted from the nematode into the plant tissue. The third was to determine if a putative peptide hormone was localized to the intestine of the nematode and if it had physiological effects on the nematode.

In the CM project we used *Agrobacterium rhizogenes* mediated transformation of soybean and tomato to obtain transgenic hairy roots expressing the nematode CM. The use of an inducible plant expression system allowed the generation of transgenic soybean roots that express the nematode chorismate mutase in a regulated manner. Upon induction of the mutase, the growth of soybean hairy roots and the initiation of new lateral roots are repressed and the development of the plant's vascular tissue is inhibited. The root growth defects are caused by a lack of auxin biosynthesis due to an intracellular competition for CM between the plastid and cytoplasmic compartments. In addition, we developed a real time PCR method to determine when in the life cycle of the nematode the CM is expressed. This analysis showed the CM was expressed only during the initial stages when the nematode is starting to feed from the plant.

Collectively, this data supports our model that the nematode CM is essential for feeding cell formation. The putative nematode pectate lyase could be involved in aiding the nematode penetration of the plant root. For this to be true the nematode protein must have pectate lyase activity and it must be secreted from the nematode. We produced the nematode protein in yeast under conditions that promoted enzyme activity. We determined that this nematode enzyme had pectate lyase activity with a broad pH optimum. Antibodies raised against this enzyme indicate there are multiple forms of pectate lyase in the nematode and that the protein is secreted from the worm. Based on the above information, we conclude this enzyme is likely to play a role in nematode penetration of the root.

Several putative nematode peptide hormone cDNAs were identified in our laboratory. One of these genes, a nematode adipokinetic hormone, has homology to insect hormones that control muscle contraction and fatty acid metabolism. We localized the RNA and protein and determined that the hormone was expressed in esophageal intestinal cells, in cells in the metacarpus and to cells near the stylet. Soaking the nematode in synthetic hormone stimulates muscle contraction, which indicates

that this hormone is functional in the nematode. Expression of the adipokinetic hormone in transgenic plants may prevent nematode growth and reproduction.

- b. Impact - The main outcome of this research was the characterization of three essential nematode genes. In the future we will work towards the development of protein-based inhibitors for these nematode proteins. If successful, the expression of these inhibitors in plants could yield new nematode resistance genes that will help control these damaging pathogens.
- c. Source of Funding – State, CSREES Grant Funds
- d. Scope of Impact – National

Horticulture Crop Water Requirement

- a. Plant water deficit is the major factor limiting global crop production. We have concluded a study intended to determine *Coleus x hybridus* Voss. 'Goldbound' water requirement based on physiological responses most directly related to yield: expansion, stomatal conductance, net photosynthesis, dark respiration, and survival (injury). Fully-expanded, mature leaves proved the most representative and consistent indicators of whole plant water status as measured with a pressure chamber and vapor pressure osmometer. The most consistent time for water status measurement was at night or under other low-transpiration conditions. *Coleus* survived dehydration up to six days with no perceptible injury, and 46 days based on ability to resume growth. Leaf expansion proved most sensitive to dehydration and even ceased before wilting could be perceived. Stomatal conductance and subsequent reduced intercellular CO₂ level was decreased next followed by net photosynthesis, which ceased at a water potential of -0.72 MPa. Although reduced, dark respiration never stopped throughout the water deprivation period. Leaf abscission began at a very low water potential, with all mature leaves eventually lost at -1.05 MPa. *Coleus* appeared to develop morphological and physiological resistance to water deficits less than or equal to about -0.65 MPa.
- b. Impact - Plant water deficit is the major factor limiting global crop productivity. Yield loss caused by water stress is estimated to exceed total loss from all other causes. Moreover, availability of agricultural water is declining worldwide because of increasing demand and decreasing quality. Consequently, knowledge of plant

water requirement is mandatory for increasing water use efficiency and reducing ground water pollution.

- c. Source of Funding – Hatch, State
- d. Scope of Impact – National

Early Detection of Plant Disease Sudden Death Syndrome

- a. Plant pathogens cause billions of dollars of damage to crop production every year in Illinois. Currently, plant pests and diseases are managed using chemical pesticides, resistant plant varieties, and crop rotation strategies. But no matter what control strategy is used, an assessment of control effectiveness is essential to determine what pathogen types are in the field and if these pathogen populations are increasing or decreasing over time. One soybean disease, Sudden Death Syndrome, which is caused by a fungal pathogen called, *Fusarium solani*, is slow-growing so it is difficult to get accurate counts using the current testing methods.

Researchers at the University of Illinois are excited about a new piece of equipment that will allow them to detect plant pathogens quickly and cheaply and to quantify disease-causing organisms in plants and soil samples. The equipment is known as real-time QPCR which stands for quantitative polymerase chain reaction. It uses a laser and fluorescent probes to monitor the exponential increase of DNA molecules in real time. This method allows for fast, reliable identification of pathogens like the soybean cyst nematode and *Fusarium solani*.

- b. Impact - This equipment will drastically decrease the time it takes to detect plant pathogens and to conduct tests on new strains of soybean to determine if the new soybean is resistant to plant pathogens.
- c. Source of Funding – Federal, State
- d. Scope of Impact - National

Key Theme – Plant Production Efficiency

Management of Grain Quality and Security for World Markets

- a. Approximately 19 percent of the corn produced in the United States goes into some kind of a wet-milling operation. For corn being wet-milled, each percentage point gain in extractable starch is estimated to be worth four-to-six cents per bushel. Extractable corn starch varies from as low as 50 percent to as high as 72 percent dry basis, with an average of around 65-1/2 to 66 percent. If a wet-miller could measure the extractable starch to determine what varieties are above the mean, they could improve their process flow by several percentage points. To make that happen, technology is needed that can measure extractable starch in a timely manner.

Researchers at the University of Illinois have developed a Near Infrared Transmission (NIT) calibration to measure extractable starch in corn. The current laboratory method, called the 100-gram Extractable Starch Test, takes three technicians eight hours to do eight tests. By contrast, researchers can run dried corn through an NIT unit and obtain an answer in about one minute. The standard error of prediction is about 1.3 percentage points of extractable starch.

- b. Impact - This technology will give wet-millers, in a fairly quick period of time, a method which they can use to deliver select varieties of corn that are high in extractable starch. These varieties could then be grown and marketed in the geographical areas around various wet mills.
- c. Source of Funding – Hatch, State, Multi-State Funds
- d. Scope of Impact – IA, IL, IN, KS, KY, MI, MN, MT, ND, NE, TX, WA, WI

Characterizing Weed Population Variability for Improved Weed Management Decision Support Systems to Reduce Herbicide Use

- a. In 2002, a field experiment was set up to evaluate weed growth and seed production at four different emergence times in corn spaced in 76 cm rows. The weed species examined were four grasses; giant foxtail, woolly cupgrass, barnyardgrass, and large crabgrass; and four broadleaf species; common waterhemp, velvetleaf, common lambsquarters, and jimsonweed. There were four weed planting times: at planting, VE-, V1-, and V3-corn growth stages. Weed emergence and growth patterns were

monitored throughout the growing season. Weather conditions (i.e., precipitation) had a major effect on weed growth at the different emergence timings. Across all cohort emergence timings, common waterhemp mortality was the highest. Seed production and weed growth data are currently being analyzed. In the fall of 2001, weed seed packets made of no-see-um netting were buried at 0, 2 and 10 cm in a no-till and conventional tillage system. Each packet contained 100 seeds of an individual weed species. There were six species buried: giant foxtail, common lambsquarters, velvetleaf, giant ragweed, common waterhemp, and woolly cupgrass. These seed packets will remain in the soil for 1 year, and will be excavated in November of 2002 to determine seed decay. Measurements that will be taken for the seeds include: number of seeds decayed, number of seeds germinated, and percent viability on the remaining seeds.

- b. Impact - This research will help build a crop yield loss model and a weed seed decay model. The information gained from these experiments will be used in the decision support software, WeedSOFT. The addition of this information to WeedSOFT will increase the power of the model to enhance the decision making abilities of WeedSOFT.
- c. Source of Funding – Hatch, State, Multi-State Research Funds
- d. Scope of Impact - CO, IA, IL, IN, KS, MI, MN, MO, MT, ND, NV, OH, SD, TX, WA, WI

Key Theme – Plant Production Systems

Pest Management for Transitioning and Organic Vegetable Production Systems

- a. This project has the following objectives: 1) to determine how changes in production practices during transition from conventional to organic vegetable production affect pest and beneficial insects and other arthropods; 2) to explore insect-weed and insect-crop relationships as they influence insect population dynamics and crop production in organic and alternative production systems; 3) to support multidisciplinary research programs in consultation with organic producers in the development of sound management options for pest complexes (insects, weeds, and pathogens), improved soil health, and production of high-quality produce in organic and other alternative

vegetable production systems; and 4) to assist in development and implementation of producer, market-chain and consumer surveys designed to assess opportunities for growth of organic food production and food products in Illinois.

A new ten-acre site is being developed by the Illinois Natural History Survey for cooperative research with the University of Illinois in the area of pest management for organic systems, primarily organic vegetable cropping systems. This site will be used for long- and short-term studies on optimizing the transition-to-organic process to build soil health and reduce pest problems. It will complement the six acres of land that is ready for organic certification this year. Current members of the multidisciplinary research group include experts in soil fertility, soil invertebrates, insect pest management, weed science, and cropping systems. An advisory board of organic growers is being formed to work with the research group in developing research objectives.

- b. Impact - This research will provide new opportunities for targeted research and educational programs in organic vegetable systems applicable to Midwestern conditions. By conducting research on land designated for organic certification and by working directly with organic growers, the proposal participants will also develop a basis for collaborative programs that will increase the direct relevance of the research to organic producers.
- c. Source of Funding – Hatch Funds
- d. Scope of Impact – Illinois

Key Theme – Precision Agriculture

Fuzzy Controls for Mechatronized Off-Road Equipment

- a. Recent advances in precision farming, agricultural machinery and information technologies have enabled many farmers to manage their fields site-specifically. Precision farming can give the farmer an economic and environmental advantage, but it also requires more on-the-go management decisions and can add to the stress of the extended, labor-intensive work levels many farmers experience. In addition, the farm labor force is shrinking (there are fewer family farms and fewer people willing to stay on the farm) and aging (60 percent of all farmers are over the age of 60). It is increasingly difficult to find experienced drivers, and the aging agricultural worker finds it difficult to work all day because of the tedious and laborious tasks.

Researchers at the University of Illinois have developed an automatic guidance system that can pilot a tractor or combine through a field. An advanced steering control system drives the machine automatically, while a Global Positioning System (GPS) sensor determines the tractor's precise location in the field, a video camera scans the immediate surroundings and other sensors determine the tractor's motion and calculate its path.

This technology has been successfully tested on six vehicles. One of these tractors has driven itself for several seasons, both day and night, doing planting and cultivation at normal operating speeds.

- b. Impact - Because automatic guidance can drive a tractor across a field precisely, it eliminates the likelihood of gaps or overlaps when planting seeds or applying chemicals. Free from the task of driving, operators will be able to focus on other on-the-spot decisions and monitor any precision ag equipment they might have. Automatic guidance will also help fulfill the labor requirement, as well as reduce farmers' fatigue. This will in turn lead to increased safety and productivity.
- c. Source of Funding – Hatch, State, Industry Funds
- d. Scope of Impact – National

Improved Application of Pest Control Substances

- a. To take full advantage of precision agriculture, producers need the most accurate information base possible. For example, to do site-specific application of fertilizers and herbicides, farmers need accurate maps. The use of "remote sensing" as a more economical and precise way to collect field data and generate maps has advanced the technology supporting precision agriculture. However, to increase the accuracy of these maps and the efficiency of precision agriculture, researchers believe there is still much to learn about the sensors and sensing system.

The Illinois Laboratory for Agricultural Remote Sensing (ILARS) was established, in part, to engage U.S. agribusinesses in applied remote sensing research and to develop practical tools in the areas of sensing, image processing and data processing. Originally, ILARS worked with NASA and their Commercial Remote Sensing Program to obtain airborne and satellite images that could be used in research to develop these tools.

However, because timing is critical when studying topics such as nitrogen stress or weed infestations, researchers could not rely on satellite images that might be generated days before or after the data must be collected. For this reason, ILARS purchased and modified their own remote-controlled helicopter. The helicopter has a video camera mounted on the front and requires two operators - one to fly the machine and one to control the camera. The helicopter will be used to take aerial images throughout the growing season and the accuracy of these images will be verified with ground equipment.

- b. Impact - With the development of their own system for remote sensing, ILARS has dramatically increased the ability to collect time-sensitive data. The research is continuing to refine the process of collecting aerial images and generating ground-based mapping systems in the hopes of boosting accuracy. As site-specific application of chemicals increases in accuracy, producers will enjoy economic and environmental benefits, and precision agriculture will see increased efficiency based on more precise information.
- c. Source of Funding – Hatch, State, Industry Funds
- d. Scope of Impact – National

Key Theme - Small Farm Viability

Southernmost Illinois Agriculture Alliance – Cattle Sale

- a. The Southernmost Illinois Agriculture Alliance (SIAA) was organized through a collaborative effort of University of Illinois Extension, Illinois Department of Agriculture, USDA Rural Development, the Illinois Value Added Rural Development Center at WIU, and the Southernmost Illinois Delta Empowerment Zone. A series of strategic planning sessions was held during January and February of 2002 to organize the group and develop action plans around the interests of the group.

The specialty livestock committee has focused mainly on cattle during the past year. A Pre-Conditioned Feeder Cattle Sale was held in December 2002. This program is similar to a number of pre-conditioned programs in that producers adopt similar management practices (weaning, vaccination, dehorning, castration, etc.) that are preformed at predetermined times to provide more consistency among the calves. This program was especially beneficial to the many small-scale producers in the region who do not raise enough cattle alone to satisfy the needs of feedlot buyers. Cattle buyers that participated in the sale were able to commingle calves from several smaller farms into larger lots to fit the needs of themselves or their customers due to the consistency that was achieved by the producers adopting similar management practices.

- b. Impact - The December sale sold over 300 head of feeder calves, which brought a premium of eight-to-twelve cents per pound. This premium resulted in total increased profits of over \$12,000 that went into the pockets of the participating producers. A smaller sale was held in February 2003.
- c. Source of Funding – Federal, State, Local
- d. Scope of Impact - Illinois

CSREES GOAL 2 — A Safe and Secure Food and Fiber System

Indications of the Scope of Research and Extension Programs under Goal 2 - See Appendix A.

Food safety and quality were addressed by 24 research projects during the past year. While the overall number of projects dropped by 12 from 2002, staff commitment increased. Research staff commitments included more than 14 scientist years (three more than for 2002) and almost 39 professional and technical staff years (a gain of about nine staff years).

University of Illinois Extension paid staff members had more than 280,000 face-to-face teaching contacts under this goal for a gain of more than 80,000 teaching contacts. Prior evaluations of these kinds of informal educational programs have shown between 50 to more than 95 percent of persons reached adopted approved food handling practices. In addition to these face-to-face contacts, U of I Extension workers and volunteers respond to more than 25,000 of food safety/food preservation calls annually.

Key Theme – Food Accessibility and Affordability

Impact of Technology on Rural Consumer Access to Food and Fiber Products

- a. Scientists from 11 states are exploring the attitudes of rural consumers toward television and internet sources for information search and purchase of food and fiber products. Experimental data collected from 358 rural consumers in six states suggest that exposure to internet sources leads to positive changes in attitudes toward the sources, but exposure to home shopping networks leads to negative attitudinal changes. Publications describing this research are in progress. These experimental consumers were surveyed in October 2002 to determine effectiveness of incorporating hands-on experiences on actual purchase behaviors.

Survey data collected from 2,198 rural consumers in 11 states are being analyzed; data will suggest factors that speed up or slow down the adoption of the Internet for purchase of products. Furthermore, factors have been identified that discriminate between adopters and non-adopters of the Internet for purchases. Additional analyses of these survey data, which are in progress include determination/development of the following: a) differences in information search based upon product category and

demographics, b) levels of satisfaction with product sources, c) levels of innovation of adopters of the Internet for purchases, d) effect of perceived time poverty on frequency of Internet purchases, and e) a profile of adopters and non-adopters of the Internet for purchasing products. Fact sheets and a website have been developed to describe progress on this project. Follow-up panel data are currently being collected.

- b. Impact - Eleven states are participating in this regional research project, which assesses rural consumer shopping patterns and attitudes toward the use of computer and television shopping technologies. The project will increase understanding of rural consumers and will facilitate development of programs that familiarize rural consumers with the broad array of product information about and convenient sources of food and fiber products. These data will also help rural retailers adjust to the changing marketplace, thereby enhancing economic and community development in small town areas.

All consumers purchase food and fiber products, making the project relevant to all areas of the U.S. In particular, non-metropolitan areas in the U.S., being a growing segment of the population, will benefit. Specific outcomes include the following: a) decrease barriers to consumer use of emerging communication technologies, b) provide basis for development of Extension consumer counseling programs related to survival and quality of life in rural communities, c) inform both product and service providers as well as consumers about access to product information, d) develop Extension and rural community programs that strengthen rural small business development through technology transfer, and e) help small retailers incorporate appropriate technologies into their business operations to adjust to the changing business climate in the 21st century.

- c. Source of Funding – Hatch, State, Multi-State Research Funds
- d. Scope of Impact - CO, IA, IL, MI, MN, ND, NE, OH, SD, TN, WI

Plant-A-Row-for the Hungry

- a. According to the U.S. Department of Agriculture, one-in-ten households in the United States experiences hunger or the risk of hunger. The Garden Writers Association reports on their website that approximately 25 million people, including 9.9 million children, have substandard diets because they cannot always afford the food they need. In the past year, the demand for hunger assistance has increased by 40% and records show that each year hundreds of hungry children and adults are turned away from food banks each year because of lack of resources.

As a solution to this growing problem, the Plant-A-Row for the Hungry movement began about seven years ago in Anchorage, Alaska. Former Garden Writers Association president, Jeff Lowenfels asked local gardeners to plant a row of vegetables for Bean's Café, an Anchorage soup kitchen. Through the support of Garden Writers, the movement has expanded across the country. In both 2002 and 2003, over one million pounds of garden produce was donated nationwide to local food banks, soup kitchens and service organizations.

In 2000, realizing the need to feed the hungry in Illinois, the University of Illinois Master Gardener program adopted the Plant-A-Row for the Hungry as a state project. Master Gardeners from counties around the state rallied to the cause in their home and community gardens. In 2002, Illinois Master Gardeners donated approximately 100,000 pounds of produce and in 2003 that number increased to close to 140,000 pounds.

Different county groups have implemented the program in different and creative ways to best fit the needs of local communities. For example, in Champaign County, Master Gardeners organize drop-off sites at local grocery stores as well as at a popular local Farmers Market. When the Farmers Market closes each Saturday, the farmers donate their unsold produce, which is then transported to the local food pantry sites. In DeKalb County, Master Gardeners organize and staff three pick-up locations for produce. The vegetables and fruit are then donated to three food pantries and senior centers. Master Gardeners from Montgomery County, collect produce for donation to the Salvation Army Battered Women's Shelter, Meals-on-Wheels, a substance abuse center and the local Housing Authority.

Several Master Gardener groups have planted large gardens with the sole purpose being to donate all the harvest to the needy. Peoria County plants a 40 foot by 75 foot garden each year at a local church with 25% of the produce being given to the church for distribution and 75% being donated to the Salvation Army. DuPage volunteers plant and maintain two community garden plots to provide fresh vegetables for the hungry. More often than not, these gardeners grow a wide variety of vegetables, small fruits and fresh herbs for cooking. Even cut flowers are donated to the shelters to booster morale while filling hungry mouths.

Both Cook County North Suburban and McHenry County Master Gardeners have been recognized for their efforts with the PAR campaign. Both of these counties received the Illinois Master Gardener Teamwork award for their efforts to feed the hungry in 2002. McHenry County volunteers planted and maintained two gardens. In order to publicize the program and increase community involvement, the gardeners organized and manned a booth at the local Gardenfest and gave talks to the community. One of the gardens, the Harvard Growing Together Garden is a community effort bringing community members, Master Gardeners and civic organizations together with a common goal. Master Gardeners from North Suburban Cook County planted a vegetable garden at the Friendship Park Conservatory. Senior gardeners trained interns about growing, picking, harvesting, and cleaning the produce. The harvest is donated to the Ceda Center in Palatine for donation to the Palatine Township Pantry.

In late July at a Plant-a-Row donation site in Winnebago county, a regular donor mentioned to the Master Gardener that she had set a goal of 1000 pounds. Mona Brower is an avid vegetable gardener. She was disappointed that she no longer had enough relatives or co-workers with which to share the bounty of her garden. Then one day while listening the University of Illinois Extension Garden Show on her favorite radio station, she learned about the Plant-A-Row for the Hungry Program in Winnebago County. Mona was delighted because now she had a way to enjoy gardening and help others. Mona exceeded her 2003 donation goal by contributing 1145 pounds of vegetables and fruits from her backyard.

The mission of the University of Illinois Master Gardener program is “Helping Others Learn to Grow”. Master Gardeners have incorporated their desire to educate others with their goal of feeding the hungry. The historic Plant-A-Row Garden in Jo-Carroll

County is one example. This garden (a winner of the 2003 Illinois Master Gardener Teamwork award) is based at the Galena Historic Museum. The garden is planted with heirloom varieties and gardening is done with historically accurate techniques. Produce is donated to the Galena Food Pantry.

Educating young people about growing vegetables and improving their nutrition is another goal realized by Illinois Master Gardener volunteers. In Tazewell County, Master Gardeners (in conjunction with the “Leave No Child Behind” initiative) bring ICC affirmative action high school students into the garden to learn about vegetables and to grow food for the needy.

During the last several school years, Master Gardeners from Moultrie-Douglas County have assisted fifth-grade science classes from Arthur, Illinois to start plants to be transplanted into a Plant-A-Row for the Hungry garden behind the school. They also started many of the their plants directly from seed in their garden. This project has been not only educational, but a community service project as well, teaching the children about gardening, nutrition, sharing, teamwork, and responsibility.

The Plant-A-Row program in Illinois has been an overwhelming success. The program continues to grow and expand each year with the help of University of Illinois Extension Master Gardeners and the Horticulture team.

- b. Impact - During 2002 and 2003, 240,000 pounds of produce were used to feed the hungry.
- c. Source of Funding - Federal, State, Local
- d. Scope of Impact - Illinois

Advanced Technologies for the Genetic Improvement of Poultry

- a. Proper assessment of factors contributing to failure of an egg to hatch, i.e., infertility and embryonic mortality, is important in poultry production. A model consisting of the sum of two cumulative logistic distributions was proposed previously to estimate probabilities of infertility and mortality, and to model parameters of a diphasic logistic distribution for time of mortality during incubation by the method of least squares.

We propose four recommendations to improve the model and the method of estimation. First, probabilities of infertility and mortality should be estimated as observed proportions rather than as model parameters. Second, parameters of the distribution for time of mortality should be estimated using a diphasic Weibull distribution rather than a diphasic logistic distribution. Third, parameters of the distribution for time of mortality should be estimated using noncumulative proportions rather than cumulative proportions. Fourth, parameters of the distribution for time of mortality should be estimated by maximum likelihood rather than by least squares.

The minimum Hellinger distance, however, is a good alternative to maximum likelihood to estimate distribution parameters if the distribution of mortality is not known exactly or if the data contain outliers.

- b. Impact - This improved model and method of estimation has been used to assess the influence on probability of failure to hatch and of storage days, and can be used to assess other effects on probability of failure to hatch.
- c. Source of Funding – Hatch, State, Multi-State Research Funds
- d. Scope of Impact - AR, CA-D, DC, GA, IA, IL, IN, MA, MI, MN, NC, TX, WI

Key Theme -- Food Quality

Maximizing Health Benefits of Crucifers

- a. Broccoli packs a healthy punch, but not necessarily every time you eat it. A lengthy series of experiments shows that the healthiest broccoli contains high levels of antioxidants — carotenoids, tocopherols, ascorbic acid, and flavonoids — that inhibit free radical reactions in the body, reducing oxidative damage and promoting cardiac health. The carotenoids lutein and zeaxanthin also have been associated with a

reduced risk of macular degeneration. Other component glucosinolates called glucoraphanin and glucobrassicin protect against cancer.

But one time you can buy a head of broccoli, cook it and get a good dose of compounds that can reduce the oxidative stress on your cells or contain a high level of glucosinolates that can reduce the incidence of cancer, but you can go to the store a week later and buy another head that has almost none of these beneficial compounds.

A recent study published in the Journal of Agricultural and Food Chemistry reported that broccoli is not just broccoli. The researchers created a database of 50 broccoli varieties and their amounts of antioxidants and cancer-fighting compounds. Some varieties had ten times the vitamin E, twice the vitamin C and eight times the beta-carotene. The broccoli varieties also ranged widely in their amounts of glucosinolates, which break down carcinogens and suppress the growth of cancer tumors.

Environment and plant genetics appear to affect broccoli's contents. The research continues to evaluate data on the antioxidant vitamin levels of broccoli grown over four years in four different environments.

- b. Impact - The findings will help plant scientists focus on environmental or genetic adjustments to improve the nutritional qualities of broccoli. Understanding the mechanisms that trigger the release of important compounds will open the door to genetically regulating the amounts of health-promoting compounds that crop plants produce.
- c. Source of Funding – NRI Competitive Grant Funds
- d. Scope of Impact – National

Strategies to Reduce the Response of Slaughter Weight Pigs to Handling Stress

- a. The objectives of this project are to develop improved pre-slaughter handling practices for finishing swine. Five experiments have been carried out to establish the effects of handling intensity and dietary treatment on the stress response (change in blood acid-base status) of finishing pigs subjected to a standardized animal

handling model.

The studies include: 1) effect of animal handling intensity on blood acid-base balance in slaughter weight pigs; 2) effect of live weight and gender on blood acid-base balance in slaughter weight pigs; 3) effect of supplementary magnesium and pre-slaughter handling on blood acid-base balance and energy substrate utilization in finishing pigs; 4) effect of L-carnitine and oil supplementation on acid-base balance and energy substrate utilization in finishing pigs; and 5) effect of dietary electrolyte balance on blood acid-base balance in finishing pigs. Further studies are currently under way to further understand the various factors that are contributing to the stress response during animal handling. When these preliminary trials are completed, large-scale commercially-orientated trials will be designed based on the results of the initial research.

- b. Impact - This research will provide guidelines on appropriate methods to feed, handle and manage slaughter weight pigs prior to slaughter to minimize the stress response and improve animal welfare and pork quality.
- c. Source of Funding – Hatch, State, Sale of Products Funds
- d. Scope of Impact – National

Improvement of Thermal and Alternative Processes for Foods

- a. Variability of modified food starch characteristics is an issue for both starch processors and end users of modified starch. It is thought that the identity of the corn hybrid plays a role in modification characteristics, but since hybrids are mixed as they enter the wet milling process, their influence has not been determined.

Waxy and regular dent corn hybrids were laboratory wet milled to obtain starch for processing. Starch samples were acetylated using a typical modification process and characterized using a rapid viscoamylograph (RVA). Efficiency of the reactions were determined. In waxy corn starch samples, an effect due to hybrid was found, but no consistent trends were observed in the waxy hybrids tested. Differences were detected due to crop year. Interestingly, no correlation ($R^2 < 0.3$) between RVA properties, widely used to characterize starches, and reaction efficiency were observed. Dent starch results are now being analyzed.

A second objective is to identify and describe transport mechanisms occurring in food processes. Fouling of food processing equipment is a major problem in the food industry since many process streams contain proteinaceous compounds responsible for fouling. Of interest was the effect of fouling on efficiency of the corn refining industry, which depends on evaporator concentration of various process streams, such as corn steepwater, to allow handling and storage of co-products. Implications of process design on fouling rates of corn steepwater are being measured using an annular fouling probe.

Improvement in efficiency of this process would have dramatic impact on process economics as well as product quality. Microfiltration membranes were used to filter corn steepwater to reroute large protein and carbohydrate molecules away from evaporators. To measure effects of membrane filtration, the fouling probe was used to measure relative rates of fouling of unfiltered steepwater and material permeating the membranes. It was determined that microfiltered steepwater had fouling rates five times slower than those unfiltered steepwater.

- b. Impact - For adding value to co-products and for maintaining competitive processes, an understanding of how biological materials interact with food process equipment is needed. Biological variability in corn starch can result in undesirable characteristics in food systems. Process changes may reduce the amount of energy needed to concentrate agricultural solids for higher valued co-products.
- c. Source of Funding – Multistate Research, USDA Grant Funds
- d. Scope of Impact - CA-D, DE, FL, GA, IA, ID, IL, IN, MI, MO, NC, ND, NE, NJ, NYC, OH, OR, PA, SD, TX, WA, WI

Antibiotic Residue Contamination in Milk

- a. Antibiotic residues can contaminate milk when producers use the drugs to treat dairy cattle. When evidence of such contamination is found, the milk is dumped, representing an economic loss for producers.

University of Illinois Extension, under the leadership of Richard Wallace, Extension dairy veterinarian, launched a five-year educational program to help Illinois producers and the industry

eliminate antibiotic residues in milk. The multi-faceted effort involved speakers at Extension's Dairy Day series, an annual fall conference for veterinarians, the annual Illinois Sanitarians and Field Representatives Conference, a book on milk quality, and a checklist of best management practices sent to all of the state's dairy producers. Information was also included in a semi-annual newsletter sent to producers.

Illinois dairy producers have met and surpassed the national standard. Every load of milk from the state's dairy farms is tested and, if the milk has any antibiotic residue contamination, it is dumped and not allowed on the market. Illinois producers have consistently produced milk that comes in below the U.S. average of 0.1 percent.

- b. Impact – Higher quality product for consumers; reduced loss for producers.
- c. Source of Funding – Federal, State
- d. Scope of Impact – Illinois

Key Theme – Food Safety

Private Strategies, Public Policies and Food System Performance

- a. Research under this project has measured the costs and benefits associated with improved food safety. It has explored the use of different market institutions and regulations for assuring safety, including how standards are set and enforced, how safety is marketed to consumers, and how food safety standards can be barriers to international trade. Findings have demonstrated the rising marginal costs of improved safety, the clear willingness to pay for safety among certain consumers, the efficiency of product standards over process standards, and the benefits of government intervention to facilitate markets for improved safety.
- b. Impact - Research has been widely reported in the trade press and contributes to ongoing discussions of challenges facing the food industry. Research has informed policymakers in both domestic and international agencies that deal with food safety.
- c. Source of Funding – Hatch, State, Multistate Research, Industry Funds

- d. Scope of Impact - IA, IN, NE

Food Safety and Food Preservation Teaching Contacts

- a. Food selection, preparation, preservation, and storage present food safety challenges. University of Illinois Extension is recognized by many consumers as a resource for answering questions and concerns relative to food safety and preservation. Annually, Extension personnel receive over 25,000 requests for help relative to food safety and preservation. Telephone interviews with samples of these consumers reveal that more than 95 percent of them adopt the practices recommended by Extension.
- b. Impact - Between 1999 and 2003, there have been more than 121, 250 instances where consumers have used Extension to help them adopt food safety practices. This understates the full impact of Extension on consumer food safety practices as it does not include the impact of circular letters, website information and group instruction in food safety by Extension staff and volunteers.
- c. Sources of Funds - Smith-Lever, State, Local
- d. Scope of Impact - Illinois

Key Theme: Food Security

4-H “Can” Make a Difference

- a. For the fifth year in a row, University of Illinois Extension’s *4-H “Can” Make a Difference* anti-hunger initiative was presented the Statewide Food Drive of the Year Award for outstanding leadership on behalf of Illinois citizens in need. The Illinois Food Bank Association and America’s Second Harvest presented the award to Illinois

The program has hundreds of corporate and organizational sponsors, including Illinois food manufacturers, agricultural commodity groups, state agencies, banks, businesses, and civic groups. A key to the program’s success is the outstanding statewide leadership of a team of collegiate 4-H youth. The members of the coordinating team connect 4-H clubs with local food pantries, shelters and meal programs. University of Illinois Extension educators are working to produce curriculum materials for youth groups that are concerned about local, state, national and

global food insecurity issues. The project provides youth a first-hand look at hunger and helps them design strategies for action. The project should be unveiled this summer in concert with the kick-off of the annual 4-H CAN Make A Difference campaign.

- b. Impact:- Last year the 4-H youth reached the magic milestone of more than 1,000,000 pounds of food collected (500 tons).
 - Youth contributed more than 1.5 million hours of volunteer service at local food banks, pantries, shelters and meal programs throughout the state.
- c. Sources of Funds - Smith-Lever, State, Local, Private
- d. Scope of Impact - Illinois

Key Theme: Foodborne Illness

Commercial Food Handlers Need to Wash Their Hands Too

- a. According to the National Restaurant Association, the average foodborne illness outbreak costs a single business \$75,000 including lost business, medical costs and litigation. As of 1999, Illinois requires certified food service sanitation managers to attend a minimum of five hours of training to retain their certification. Over the past five years, 2,770 foodservice staff have been re-certified through refresher courses taught by University of Illinois Extension Educators. These courses have done more than meet a minimum re-certification requirement; over 79 percent reported improving one or more food handling practices as a result of the training. Since many establishments have only three or four certified employees, one can assume that this training has impacted close to 800 establishments (assuming 3.5 trainees per establishment).
- b. Impact - 2,188 food handlers improved one or more food handling practices.
 - 800 food establishments now serve safer food.
- c. Source of Funds – Federal, State
- d. Scope of Impact – Illinois.

CSREES GOAL 3 — A Healthy, Well-Nourished Population

Indications of the Scope of the Research and Extension Programs under Goal 3 - See Appendix A

Last year the College of ACES had a total of 30 research projects relating to Goal 3. These efforts include almost nine scientist years and more than 37 staff years of technical and professional staff support. University of Illinois Extension had almost 700,00 face-to-face teaching contacts related to maintaining a healthy, well-nourished population. College and Extension WWW sites related to human nutrition received more than one million “hits” each month.

Key Theme -- Human Health

FARM Program Raises Standards for Ag Equipment Visibility

- a. Enhancing the visibility of agricultural equipment on public roadways is an ongoing concern for the farming community, the Illinois Department of Transportation and the Secretary of State. In recent years, there have been an increased number of accidents involving farm equipment or implements of husbandry. In a seven-year study, Illinois averaged 235-to-240 accidents per year, with more than a hundred serious injuries and six deaths each year. Because farms are getting larger, farmers must often travel farther on narrow rural roads that were constructed decades earlier. New farm equipment is larger and can extend into the opposing lane of traffic. The markings on older farm equipment can be poor or non-existent. As a result, the driving public is often unaware of the need for caution or does not see the equipment quick enough to react appropriately.

The FARM (Fewer Accidents with Reflective Materials) coalition was established as a collective effort of 18 organizations, including the University of Illinois Extension, Illinois State Police, Illinois Secretary of State, Illinois Farm Bureau, and the Midwest Equipment Dealers Association.

FARM encourages farm operators to apply new retro-reflective material to their equipment in a standardized and recognizable manner in an effort to reduce the number of farm equipment accidents on rural roadways. To this end, researchers at the University of Illinois developed a kit for marking farm equipment and provided much of the leadership for the FARM effort. The kit

is based on research that addresses issues such as lighting, retro-reflective material, color scheme and minimum size of markings for basic effectiveness. The kit includes a slow-moving vehicle (SMV) emblem made with retro-reflective and fluorescent material that meets the new standards established by the American Society of Agricultural Engineers (ASAE).

- b. Impact - Based partially on information provided by the FARM program, the ASAE passed a new standard for marking farm equipment which became effective in 2000. Also, John Deere used the FARM kit as the model to improve the markings placed on their new farm equipment. They began putting these kits on new machinery in late 1999.

In 2001, there was unanimous agreement in the Illinois agricultural industry to pass a standard that would require that the new retro-reflective SMV emblem be placed on all farm equipment moving on public roadways by September of 2004. Currently, close to 25,000 pieces of farm equipment are marked with the FARM kit.

Approximately 20-to-25 states have picked up the FARM kit and are promoting it in their states.

- c. Source of Funding — Federal, State
- d. Scope of Impact — National

Radon Education

- a. Radon is a health risk facing millions of families across the country. The Academy of Sciences estimates that radon causes between 15,000 and 22,000 U. S. deaths from lung cancer annually. Since radon can be a problem in all types of homes, University of Illinois Extension began partnering with the Illinois Department of Nuclear Safety (IDNS) to educate residents about radon exposure as a public health issue.
- b. Impact - Nineteen (19) Extension Unit Offices purchased over 900 radon detectors to make them more assessable and affordable for the public to test their homes. Three hundred ninety-seven (397) of those detectors have been analyzed with results sent directly to the homeowner. One county reported that 73% of the homes tested have elevated levels of radon. Two counties reported 70%; one reported 50%; and one 40%. The Extension offices are now

working with health departments to follow-up with the people who have bought detectors in the county. A staff member from the health department will attend the radon mitigation course and work with families one-on-one to help them consider their options for reducing the radon levels in the home.

- One hundred sixty five individuals with high levels of radon in their homes were made aware of the situations and were ready to handle it properly and promptly because of the information received through this radon awareness project; thus, have healthier home environments for themselves and their families.

In addition to the documented impacts, millions of Illinoisans have been made aware of the dangers of radon through a variety of approaches:

- Radon fact sheets distributed statewide to sixth grade teachers, students and parents.

- Newsletters focused on radon distributed to students in grades two and three in 26 Illinois counties and 87 educators in 13 states.

- Radon press releases were used in 75 newspaper articles across the state.

- More than 15,000 youth and adults visited a display on radon reduction during a the U of I Engineering College Open House.

- Radon displays were used at 18 fairs.

c. Source of funding - Federal, State, Local

d. Scope of Impact - Illinois

Key Theme -- Health Care

Nutritional Adequacy of Food Selections of Hospitalized Patients

- a. We continue to make progress analyzing the data from our study on the impact of the traditional à la carte meal selection approach in the hospital environment compared to a novel limited alternative structured diet. Primary outcomes are nutritional adequacy and patient satisfaction. Our data demonstrate that overall patient satisfaction remained high and was similar between the à la carte and structured diet.

Patient's perception of meal variety was minimally diminished with the more restrictive diet approach. Perceptions of quality appeared to increase. Assessment of portion sizes remained essentially unchanged. In the upcoming year, we will proceed with analyzing data concerning actual food consumed with both menu or diet selections. We will be examining whether the patient's perceptions of satisfaction, variety, quality, and portion size are reflected in actual food consumption. In addition, we will be examining the comparative nutritional adequacy of the two diet approaches.

- b. Impact - Assessment of the nutritional adequacy of diets provided in the hospital is important as meal selection options change due to nutritional and non-nutritional factors. Furthermore, it is important to understand the impact that these changes have on the quality of the diet consumed by patients in the hospital. This knowledge will allow for the design of nutritionally optimal diets with high patient satisfaction ratings.
- c. Source of Funding — Hatch, State
- d. Scope of Impact — National

Key Theme -- Human Health

Food Toxicology and Safety - Estrogen Found in Soy Stimulates Human Breast-Cancer Cells in Mice

- a. Previously our laboratory has shown that the soy isoflavone, genistein, stimulates growth of human breast cancer (MCF-7) cells in vivo using the athymic mouse/tumor implant model. In this

study we induced mammary cancer in the rat with NMU and allowed tumors to develop. After tumors developed rats were ovariectomized and assigned to three groups: Control (AIN93G diet), Estradiol silastic implant and dietary genistein (750ppm in AIN93G).

This study design will allow us to evaluate the dietary effect of the estrogenic isoflavone, genistein on tumor growth in a model that mimics the estrogen environment of a postmenopausal woman. We have demonstrated that dietary genistein at 750 ppm in the AIN93G diet can stimulate growth of NMU-induced (estrogen responsive tumors. Blood genistein levels were determined and are similar to those observed in women consuming diets high in genistein.

- b. Impact - These data utilize a carcinogen-induced animal model and demonstrate that the dietary estrogen genistein can stimulate estrogen-dependent tumor growth. These data also have implications that warrant caution for post-menopausal women with breast cancer who consume dietary estrogens.

The pre-clinical laboratory animal data suggest that caution is warranted regarding the use of soy supplements high in isoflavones for women with breast cancer, particularly if they are menopausal.

- c. Source of Funding – Hatch, State, Public Health Service Funds
- d. Scope of Impact – National

Prion Diseases Project

- a. Prion diseases like Chronic Wasting Disease (CWD) in deer and Mad Cow Disease in beef and dairy cattle and its human form, Creutzfeldt-Jakob Disease, have wreaked economic havoc in Great Britain and Europe and now threaten hunting-related and livestock enterprises in the Midwestern United States. Little is known about the initiation and transmission of prion diseases and all are incurable at this time. Standard responses to outbreaks of the animal prion diseases are quarantine and slaughter, even including the prohibition against growing crops on land used by diseased animals.

A multi-disciplinary research approach based in the University of Illinois Department of Animal Sciences has been launched to seek

answers to the questions surrounding prion disease and, possibly, develop intervention strategies. University of Illinois and Illinois Department of Natural Resources Illinois Natural History Survey researchers are aiming at four broad goals: generating a "risk" map for CWD in Illinois; determining if there are environmental reservoirs that favor development and transmission of prion diseases; the potential for interspecies

transmission of prion diseases; and the development of prevention strategies.

- b. Impact - Progress in understanding prion diseases could have a major economic impact on the livestock industry worldwide. In Illinois, especially if prevention strategies develop, the impact can be measured in the avoidance of a negative. If prion diseases were to spread from the deer population to beef and dairy cattle, Illinois could face major economic disruption and loss in its agricultural sector.
- c. Source of Funding – Federal, State
- d. Scope of Impact – National, International

Characterization of the Effects of Isoflavones (Gentistein) on Hepatic LDL Receptors

- a. The first trial for this proposal is underway. Male estrogen receptor (alpha receptor) knock out (ERKO) and wild type mice are being obtained from the breeding colony of Dr. Paul Cooke in the College of Veterinary Medicine. Mice are added as they become available. At 53-55 days of life they are placed upon laboratory blocks (control) or on one of three hypercholesterolemic diets. The hypercholesterolemic diets have 15% butter fat, 1% cholesterol and 0.5% sodium cholate and have 20% protein from casein, isolated soy protein or ethanol-washed isolated soy protein. The latter diet is essentially devoid of isoflavones.

One goal of the study is to determine the role of soy isoflavones on the hypocholesterolemic properties of soy protein. After 3 months of feeding, mice will be killed and blood and tissues will be taken for lipid analysis. We will also evaluate the expression of LDL receptor mRNA in blood monocytes and in the liver. At the time of this report, none of the 37 mice so far placed on the protocol have completed three months of feeding. The goal is to have 12-15 mice

per group.

- b. Impact - The hypothesis is that ERKO and wild type mice fed isolated soy protein with isoflavones will have reduced serum and tissue cholesterol levels compared to casein fed mice. Mice fed the soy diet with reduced isoflavones will have intermediate levels. Comparison of the ERKO and wild type mice and LDL receptor mRNA levels will yield clues of the mechanism of action of the soy protein containing isoflavones. Together, these studies will help consumers choose the correct type of soy product to achieve cholesterol reduction.
- c. Source of Funding – Hatch, State, Other Non-Federal Funds
- d. Scope of Impact - National

Honey has Potential as Dietary Antioxidant

- a. A U of I study shows that honey has potential as a dietary antioxidant. Antioxidants are thought to protect body cells from the damaging effects of oxidation. They fight damaging molecules in the body called oxygen-free radicals that may contribute to the aging process as well as the development of cancer.

Building on a 1999 University of Illinois study, researchers measured the antioxidant and phenolic contents in honeys taken from seven floral sources. Researchers used the oxygen radical absorbance capacity (ORAC) assay, a tool that has been widely used for the past decade to analyze the same components in fruits, vegetables and wines. ORAC values ranged from three-to-seventeen; commonly consumed fruits and vegetables generally range from 0.5 to 16 on a per-gram basis. The study clearly showed that there are antioxidants in honey.

- b. Impact - The study shows that honey contains healthy qualities of antioxidants, strengthening the idea of using honey as a sugar substitute. It also strengthened the results of an earlier study which showed that honey was more effective than traditional preservatives (butylated hydroxytoluene and tocopherol) in slowing oxidation in cooked, refrigerated ground turkey without affecting taste negatively.
- c. Source of Funding – Federal, State, Grant

- d. Source of Impact – National

Honey Slows Oxidation of LDL in Blood

- a. A University of Illinois study conducted with human blood in the lab showed that honey slows the oxidation of low-density lipoproteins (LDL), a process that leads to atherosclerotic plaque deposition. This is the first study to look at honey's effect on the blood.

Researchers obtained blood samples from healthy human volunteers coming off a 12-hour fast. To the blood they added various varieties of honey to assess honey's impact on low-density lipoproteins (LDL), the so-called bad cholesterol. In test samples, they also added copper to stimulate lipoprotein oxidation. Using a spectrometer, they found that honey--the darker the better--dramatically slowed the rate of oxidation related to LDL in blood.

- b. Impact - Follow-up studies, either in progress or undergoing data analyses, will shed more light on the exact phenolic compounds in honey and on how effectively honey that is consumed prevents oxidation in the blood of human subjects. Phenolic compounds are phytochemicals, compounds in foods that may carry specific disease-fighting abilities.
- c. Source of Funding – Federal, State, Grant
- d. Scope of Impact - National

Dietary Fiber And Gastrointestinal Function

- a. Malnutrition among Americans is extremely common with estimates in hospitalized patients ranging as high as 50%. Impaired gastrointestinal (GI) function is believed to be a significant contributor to malnutrition and is a problem that exists in all facets of the population. Among children, the combined cost of inpatient and outpatient care for diarrhea in the United States is greater than \$2 billion per year. In adults, impaired GI function is associated with conditions such as short-bowel syndrome, inflammatory bowel disease and Celiac disease. Similarly, malnutrition in elderly populations is believed to have reached epidemic proportions as more than 33% of individuals over the age of 65 years malabsorb a portion of a carbohydrate meal.

Despite this information, the regulation of nutrient absorption remains poorly understood. It is our central hypothesis that the addition of SCFAs to TPN will prepare the residual small intestine for proper digestion and absorption of orally consumed nutrients by increasing the abundance of nutrient transporters within the small intestine. We further hypothesize that the regulatory mechanism whereby SCFAs exert these effects is by upregulating an important intestinal peptide, glucagon-like peptide-2.

Preliminary data indicates that dietary fiber (such as soy fiber) and its fermentative by-products - short-chain fatty acids (SCFAs) - enhance structural and functional aspects of the GI tract in neonatal and adult animal models. Current efforts are focusing on the physiological mechanism(s) governing these effects. As an outcome of the proposed thesis research, we expect to have determined how the consumption of dietary fiber increases GI function by modulating transport processes at the cellular level. Furthermore, potential mechanisms whereby these outcomes are being modulated by the consumption of dietary fiber are being examined.

- b. Impact - This information will provide a significant advancement in knowledge. It will provide insight into therapeutic regulation of GI function with dietary fiber and potentially reduce the incidence of morbidity and mortality associated with malabsorptive disorders.
- c. Source of Funding – Hatch, State
- d. Scope of Impact – National

Bioflavonoid Analysis From In-Vivo Fruits and In-Vitro Cell Cultures

- a. Using ¹⁴C labeled carbohydrates, a series of radiolabeled flavonoids have been synthesized and isolated/separated from cell culture systems of grape and berry germplasm. Superb uptake of label (up to 55% of that incorporated into the cell production medium) and reasonable specific activities were achieved for both systems, although higher SA was consistently recorded for the anthocyanin-rich grape cell cultures. The compounds are now available for neuroprotection analysis in rodent models. A provisional patent has been filed on a relatively non-intrusive vacuum chromatography separation scheme for isolating bioactive

flavonoids from the cell culture system, and for the radiolabeling procedure.

- b. Impact - The radio labeled isolates from this project represent the first ever production of these flavonoids, which are not commercially available. Most significantly, the complex high molecular weight proanthocyanidin oligomers are of intense interest due to their multiplicity of bioactivities reported in the literature.
- c. Source of Funding – Hatch, State, Public Health Service, Industry Funds
- d. Scope of Impact – National

A Study of the Urticating Caterpillars of Midwestern Forests

- a. The prolonged wet spring of 2002 devastated many insect populations in Illinois including species of urticating caterpillars. In six field trips to southern Illinois not a single larval specimen of the ten species selected for this study were found during the summer of 2002. The same occurrence was observed in some insect species that were common in previous years. At the Natural History Survey Insect Collection 411 adult specimens of the selected 10 species were examined and data recorded as to dates when adult moths were captured, the location and the collector. This information will be of value in estimating the expected times during the growing season when larval stages will be most likely to be found.

During the 2003 growing season, a portable black light insect trap was used to capture adult female moths, collect eggs and rear the larval forms so that a better understanding of the life history of each species can be determined. Photographs will be taken of the larval and adult forms, which will eventually be published, to aide in the identification of the insects.

- b. Presently dermatologists have no colored reference materials which show the larval forms of the most common urticating caterpillars which the public are most likely to encounter and that can cause skin injuries. By showing patients colored photographs of the various species of urticating caterpillars the physician can determine what insect species was involved and will be able to recommend appropriate treatment.

- c. Source of Funding – McIntire-Stennis Funds
- d. Scope of Impact – National

Content and Physicochemical Characteristics of the Bioactive Soybean Seed Proteins: Arcelin, Lectin and Lunasin

- a. The status or stage of the work is the following: Objective 1. Diversity of concentration of lectins in soybean germplasm. To assess the genetic diversity for lectins that may be available with current U.S. commercial cultivars, we will analyze the 35 major ancestral lines of U.S. cultivars and a group of 16 recently released cultivars selected to represent all of the major pedigree groups of North American public cultivars. To sample the diversity that may be available within all of G. max we have selected 5 accessions from each of 10 provinces in China and 5 each from Korea and Japan. Previous measures of genetic diversity using molecular markers indicate that this is a reasonable strategy for maximizing diversity in a small sample. Our initial selection of wild soybean (G. soja) was 10 accessions each from China, Korea, Japan, and Russia.

The following steps have been taken: 1. Equipment and reagents were obtained; 2. The methodology was established; 3. The seeds needed for this study have been obtained; 4. Sample preparation: mature seeds have been milled into flour (mesh 60), homogenized in buffer, and clarified by centrifugation; 5. The identification and quantification of lectins of the 146 different lines of soybean have been started; 6. Vertical 12% slabs sodium dodecylsulfate-polyacrylamide gel electrophoresis (SDS-PAGE) have been carried out as described by Laemmli. Gels were stained with Coomassie Brilliant Blue R-250; 7. A densitometer Kodak Image Station 440 CF is being used for data analysis.

- b. Impact - Soybeans contain a variety of anti-carcinogenic phytochemicals. More recently, there has been increased interest in the potential health benefits of bioactive polypeptides and proteins from soybeans, including lectins. Lectins are glycoproteins that selectively bind carbohydrates and they are used in medicine in a variety of new applications. These bioactive proteins also have potential anticarcinogenic activity despite their toxicity and nutritional implications.

Plant lectins have potent biological activities in vivo and are

present in significant quantities in common foods like soybean. Therefore, human exposure to dietary lectins remains widespread throughout the world. Lectins are resistant to digestion, survive gut passage and bind to gastrointestinal cells and/or enter the circulation intact, maintaining full biological activity. Future advances in cancer prevention, detection, and treatment could potentially be achieved by using soybean lectins.

In addition to cancer treatment, soybean proteins can also be equally beneficial to bone diseases, heart disease, high cholesterol, hypertension, and obesity. Although there is still much to learn about the effects of lectins on cancer risk, this area of research holds considerable potential.

- c. Source of Funding – Hatch, State
- d. Scope of Impact – National

Mosquito and Agricultural Pest Management in Riceland Ecosystems

- a. During the summer of 2002, West Nile Virus (WNV) reached epidemic proportions in Illinois. The Medical Entomology labs research was shifted into providing surveillance for this outbreak as well as attempting to answer key biological questions regarding the transmission dynamics of this virus. A total of 8,000+ mosquito pools were tested for WNV from throughout the state. In addition, bird sera was collected via mist netting and over 1,700 samples were tested for antibodies.

The average number of mosquito pools found WNV positive was 23% statewide. A low WNV antibody rate was found in both the migrant and local avian populations. We identified the WNV in canines and in tree squirrels. Data is still being analyzed at the time of this writing.

- b. Impact - Information gained from the WNV 2002 outbreak will provide a better understanding of the transmission dynamics to both humans and wildlife, which will significantly enhance control and prevention practices in the state.
- c. Source of Funding – Multi-State Research Funds
- d. Scope of Impact – AR, CA-D, CA-R, FL, IL, LA, TX

How Natural Environments Enhance Human Functioning: Identifying the Mechanism

- a. This project involves two lines of research examining the mechanism by which exposure to "green" views and settings enhance human functioning. In both lines of research, the findings have provided strong support for the proposed mechanism.

In 2001, three journal articles describing these findings were prepared, submitted and published. In 2002, an additional article was published in a special issue of the "Journal of Environmental Psychology," and an invited book chapter describing the methodology used in this work was published in the "New Handbook of Environmental Psychology."

- b. Impact - Previous research has shown that regular contact with natural settings supports healthy human functioning. By identifying the mechanism underlying these impacts, this project should provide guidelines as to how often an individual should have contact with nature, the duration of exposure and the forms of nature that would be optimal or sufficient for enhanced functioning. Initial findings suggest that urban nature suffices for the effect, but that exposure should be frequent and perhaps extended (e.g., half an hour daily).
- c. Source of Funding – Hatch, State, USDA Grant Funds
- d. Scope of Impact – National

Key Theme -- Human Nutrition

Regulation of Phosphatase Expression and its Impact on Body Fat Deposition

- a. A feeding study using nine piglets has been completed. We also finished modification of pig microarray chips by adding 30 more genes of interest. We are currently conducting analysis of gene expression using the microarray chips and histological examination of liver samples.
- b. Impact - Obesity is a growing health problem in the U.S. It would be our responsibility as an agricultural/food research institution to take action against this challenge by exploring better nutritional intervention and by developing food production technologies to meet the goal. Understanding basic regulatory mechanism of fat deposition will contribute to this purpose in two ways. First, it will increase the knowledge in nutrition to prevent obesity. Second, the same knowledge can be utilized for leaner meat production by the animal industry.
- c. Source of Funding — Hatch, State Funds
- d. Scope of Impact — National

Hypothalamic Neurochemical Response to Leptin

- a. Leptin, released by adipocytes into the blood in direct proportion to the amount of adiposity, influences the activity of noradrenergic neurons in the ventromedial hypothalamus. These neurons are important for establishing metabolic rate. Microdialysis probes were placed into discrete areas of the hypothalamus of male Sprague-Dawley rats to monitor noradrenergic output.

In the first series of studies, norepinephrine (NE) release in several hypothalamic nuclei were measured using microdialysis probes. Exogenous leptin was infused into a carotid artery and NE release monitored in the ventromedial nucleus (VMN), dorsal medial nucleus (DMN) or paraventricular nucleus (PVN) of the hypothalamus, all hypothalamic areas involved in energy balance and containing leptin receptors. In response to leptin, NE was increased only in the VMN.

In the second series of studies, the increased NE was due to a

direct effect of leptin in the VMN, as microinfusions of leptin directly into the VMN also increased NE release. A difference in timing between peripheral and local administration is consistent with the time necessary for leptin uptake across the blood brain barrier. In the third series of studies, the increase in NE in the VMN following leptin administration was blocked by the sulfonylurea antagonist glyburide.

The results implicate the increase in NE was mediated by glucose responsive neurons in the VMH. These neurons are sensitive to glucose supply and contain both leptin and sulfonylurea receptors. Chronically elevating circulating leptin had little effect on basal NE release in the VMH; however, the threshold for activation of NE by hypoglycemia was shifted. It appears that an action of leptin within the VMH may be to influence the sensitivity to other signals reflecting short-term energy balance.

Finally, we investigated whether Leptin's action on NE release in the VMH was facilitated by a phosphoinositol 3 kinase (PI3K) pathway. The PI3K inhibitor, LY62000, was infused into the VMH 20-30 minutes after administration of peripheral leptin (no change in NE to peripheral leptin until 40 minutes). LY62000 reduced basal NE levels in leptin and control rats, but did not prevent the increase in NE to exogenous leptin. A different PI3K inhibitor will be evaluated.

- b. Impact - The influence of signals reflecting long-term energy balance (e.g., adiposity) appears to influence metabolic rate and responsiveness to acute changes in energy/nutrient balance (e.g., short-term energy balance). The primary mechanism is via hypothalamic neural systems that influence tone of the autonomic nervous system to influence pancreatic and adrenal hormones.
- c. Source of Funding – CSREES Grant, Public Health Service, State
- d. Scope of Impact – National

Combating Diabetes and Obesity

- a. A considerable public health challenge stems from the facts that the American population is overweight and Type II diabetes is occurring at almost epidemic levels. Carbohydrate consumption plays a large role in this situation.

Researchers in the University of Illinois Department of Animal Sciences are involved in a family of research projects related to this problem. The studies focus on obesity and diabetes in dogs and what works in a dog tends to work in a human. "Novel" carbohydrates are at the heart of the project. One of these in particular, pullulan cyclodextrin, modifies the glycemic index, an indicator of tolerance for carbohydrates. Tests indicate that pullulan cyclodextrin blunts the body's glycemic response, decreasing the spikes in blood sugar levels that can be an extenuating circumstance in diabetes. This carbohydrate also has a fiber-like quality that allows its substitution for traditional dietary fiber sources.

- b. Impact - This research could lead to modifications in the diets of both dogs and humans that could lower the incidence of obesity and Type II diabetes while improving fiber content without negative side effects.
- c. Source of Funding - Federal, State
- d. Scope of Impact - National

Berries Benefit Health

- a. Health-benefitting substances are available in foods, but the "dosages" are mysterious. How many glasses of cranberry juice, for example, will help prevent urinary tract infections?

Research at the University of Illinois recently discovered that one berry component (called proanthocyanidins) responsible for the anti-adherence, also have potent anti-carcinogenic properties. Natural ingredients found in high concentrations in the berries are capable of inhibiting the initiation of carcinogenesis, as well as inhibiting tumor formation. The proanthocyanidins in the berries actually interfere with the bacterial-landing mechanism, preventing them from taking hold on the rough walls of the bladder and preventing colonization that can lead to infections. The same proanthocyanidins are capable of disrupting enzymatic reactions that would otherwise lead to rampant cell proliferation in tumors.

- b. Impact - As a direct result of this conclusive research, effective dosages are able to be recommended for patients.
- c. Source of Funding - Federal, State, Grant

d. Scope of Impact - National

CSREES GOAL 4 – Greater Harmony Between Agriculture and the Environment

Indications of the Scope of the Research and Extension Programs under Goal 4 – see Appendix A

Last year the College of ACES had 82 research projects under this goal involving more than 27 scientist years and more than 97 staff years of professional and technical support. During that same year, U of I Extension had more than 158,000 face-to-face teaching contacts related to Goal 4.

Key Theme – Air Quality

The National Atmospheric Deposition Program

- a. NRSP-3, the National Atmospheric Deposition Program (NADP) provides quality-assured data and information on the exposure of managed and natural ecosystems and cultural resources to acidic compounds, nutrients, base cations, and mercury in precipitation. This is made possible through cooperative support (SAES, universities, government agencies-federal/state/local/tribal, and NGOs) of the 250-station National Trends Network, 70-station Mercury Deposition Network, and 10-station Atmospheric Integrated Research Monitoring Network.

The NADP provides the only nationwide database of precipitation chemistry in the United States today, and these data support informed decisions on air quality issues related to precipitation chemistry. NADP data are used by scientists, policy-makers, educators, and the public and are freely available via the Internet (nadp.sws.uiuc.edu). In 2002 the NADP Internet site received 46,561 unique visitors, an increase of 8.6 percent over 2001, and user sessions rose by nearly 23 percent to 134,287. This site now regularly receives more than a million hits per year or more than 4.5 times as many as in 1998, when site usage was first tracked. The number of data files downloaded from the NADP Internet site now exceeds 20,000 per year, or 1.8 times higher than in 1998. In 2002 users viewed 95,425 color-contour concentration and deposition maps, an increase of eight percent over 2001.

A feature article on environmental monitoring and national security described how NADP could assist in a national surveillance system for biological, chemical or radiological agents

spread by terrorists. NADP has previous experience in tracking disasters. In 1986, NADP provided samples that could be used to map the spread of radioactive fallout from the Chernobyl nuclear accident. NADP has more than 300 monitoring stations, an efficient communications network and a management infrastructure that stand ready to help in the nation's homeland security efforts.

In 2002, the NADP Program Office contributed to the University of Illinois Extension Service's program Environmental Stewardship Week. This event engages elementary school students in active learning centers where they participate in hands-on learning experiences on environmental science topics. NADP staff members ran a learning center that dealt with the pH of household chemicals compared with water from a nearby lake and an acid rain sample from the NADP network. This annual event attracted about 1,200 children.

In September 2002, 82 registrants attended the NADP Technical Committee meeting in Seattle, Washington. A two-day scientific symposium followed NADP committee and subcommittee meetings. Fifty papers were presented at the symposium, which covered a range of topics, including mercury in air and precipitation, stable isotope measurements, changes in clean air legislation, trends, and Western Regional atmospheric deposition issues. A special issue of the journal Atmospheric Environment featured nine papers presented at the 2000 NADP meeting in Saratoga Springs, New York.

- b. Impact - In 2002, NADP data was used to demonstrate how sulfur dioxide emissions reductions under the 1990 Clean Air Act Amendments have reduced sulfate in precipitation and how long-term high-quality measurements, such as NADP data, could be used to gauge the effects of new sulfur dioxide, nitrogen oxides, and mercury emissions reductions, which have been proposed under the Clear Skies Act sent to Congress by the U.S. President.
- c. Source of Funding – Multi-State Research Funds
- d. Scope of Impact – CA, D, CO, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MT, NC, NE, NY, OH, OR, PA, TX, UT, VA

Indoor Air Quality For Livestock Buildings

- a. Airborne particulates spatial distribution (APSD) has a direct and profound effect on indoor air quality and occupational health. One of the challenges in indoor air quality studies is to measure the APSD so that the nature of particulate transportation can be better understood and appropriate control strategies can be implemented. The existing particulate sampling technology is a single point measurement, i.e., one measurement at one point at a time. It is critical to measure APSD across an airspace at multiple points during the same time period. Otherwise, the time required for each measurement point (typically on the order of hours or days for mass concentration) will introduce large errors in APSD which are highly time dependent.

Specifically, the objectives of this proposed study are to: (1) Develop a 3-D airborne particulate spatial distribution (ASPD) sampling system based on the existing 2-D ASPD system for a full-scale testing room; (2) Develop a 3-D Stereoscopic Particle Imaging Velocimetry (SPIV) system based on the existing 2-D PIV system for a full-scale testing room; (3) Measure 3-D ASPD and air velocity distributions in the full scale room with typical ventilation systems (such as conventional mixing and displacement) at iso- and non-isothermal conditions; and (4) Evaluate the effect of ventilation systems and air velocity distribution on airborne particulate spatial distribution.

- b. Impact - There is a lack of data to develop and validate models for airborne particulate spatial distribution (APSD), primarily because of the lack of techniques or instruments to measure multi-point APSD accurately. Particles behave differently from the carrying airflow. We have developed a unique APSD measurement system that allows us to acquire the needed information. We are using this technique to study the animal building particulate matter concentration and ventilation effectiveness. The application of this technology can be used for many other indoor environment studies such as medical and industrial facilities.
- c. Source of Funding – Hatch, State, USDA, Industry Grant Funds
- d. Scope of Impact – National

Mobile Labs Study Livestock Pollutant Emissions

- a. The negative impact of air pollutants (including dust, odor and gases) emitted from animal confinement facilities has created significant public concerns. Federal and state air quality regulations use emission estimates and air dispersion modeling to evaluate the impact of animal confinement facilities on the environment and human health. However, reliable estimates of air quality emissions from livestock and poultry housing are generally unavailable. Currently, emissions from animal confinement facilities are not regulated.

The University of Illinois has partnered with the University of Minnesota, Iowa State University, Purdue University, North Carolina State University, and Texas A&M University to establish the Aerial Pollutant Emission in Confinement Animal Buildings (APECAB) project. Each institution has developed a mobile laboratory to monitor pollutant emissions from a variety of commercial animal confinement facilities. All six laboratories are identical, the exact same equipment and procedures are used in each, and each lab is technically audited on a yearly basis. The objective is to quantify the emission rates from different animal confinement facilities in terms of dust, odor and pollutant gases. Researchers will evaluate the differences in emissions due to geographical region, season of year, time of day, building design, growth cycle, animal species, and building management.

- b. Impact - One of the limitations for the growth of the livestock industry has been the concern over air pollutant emissions from production sites that include animal buildings. This study will produce a large database of information on pollutant emissions, which will make writing emission standards more practical. It is very important that accurate information be provided on emissions from animal buildings before policies are established that significantly impact animal production in the prime agricultural areas of the country.
- c. Source of Funding – Federal, State
- d. Scope of Impact - National

Key Theme – Biodiversity

Biotic Interchange of and Habitat Utilization By Insects in Agricultural and Surrounding Landscapes

- a. Key to determining the movement of biota is a knowledge of its taxonomy, phenology, larval and adult habitat, and distribution, i.e., what species are being caught, when are they caught and where they are found. In a revision that examined nearly 1,200 specimens of the stiletto fly genus *Ammonaios* (Diptera: Therevidae), three new species were added to the previously monotypic genus that was first described in 1981 by Irwin and Lyneborg. This genus is known primarily from a variety of sand dune habitats of southwestern North America, although the most widespread species has been found from western Texas, Mexico and as far north as Oregon. The other three species appear much more restricted in their range, with an overlap only with the more broadly distributed species and not with each other, based on the specimens examined in this study.

Not only are the geographic ranges separate in the less common three species, but their adult flight times are also distinct, with only a small overlap between two of the species. The more common and sympatric species has the longest flight period, from February to October, which overlaps that of the other three species. While the adults of the most common *Ammonaios* species may sometimes serve as prey for *Bembix* wasps, they have also been found resting in the relative coolness of rodent holes during the heat of the day, alighting on shiny objects such as car hoods in the early evening hours as the day cools, flying into Malaise (flight intercept) traps, attracted to lights, or associated with low vegetation. One adult female was trapped in a cotton field, suggesting the potential that the larvae may play a role in the biological control of soil dwelling arthropod pests of cotton.

The ecology of the sand dwelling, snake-like predaceous larvae remains largely unexplored, although the most common species has been sieved from both inland and coastal vegetated dunes. Another species found in southern California has been sieved from un-vegetated shifting inland dunes and one specimen was observed feeding on a tenebrionid beetle larva. However, the larval habitat of the species so far only found in Baja California remains unknown.

- b. Impact - A genus of stiletto flies found mainly in southwestern North America was previously known from a single named species. That species, it was discovered, actually represented two species under a single name, and the taxonomic work involved in this study teased these relationships apart, while discovering two additional new species in the process. Studying the specimens and observations made during their capture will enable scientists to predict possible range expansions or contractions with changing habitat and climatic conditions.
- c. Source of Funding – Hatch, State, National Science Foundation, Industry Funds
- d. Scope of Impact - National

Key Theme – Integrated Pest Management

An Integrated Pest Management Facilitator for the North Central Region

- a. In August 2001, Susan T. Ratcliffe accepted the position of North Central Regional IPM Facilitator. As facilitator, she has worked closely with the Directors (Larry Olsen, Michigan State University and Michael E. Gray, University of Illinois) of the North Central Pest Management Center (NCPMC) to assemble an advisory committee that met twice (November 27 - 28, 2001 and April 2 - 4, 2002). She assisted the chair of NCR-201, Jon Tollefson, Iowa State University, in the preparation of the annual committee meeting for North Central IPM coordinators. The annual meeting for NCR-201 was held jointly with the NCPMC state project leaders in East Lansing, Michigan on April 2-4, 2002. Other responsibilities include assisting Michael E. Gray, NCR-IPM grants manager with the dissemination of the Request for Application and preparation of the peer review panel meeting (November 29 - 30, 2001).

As pest issues emerge regionally or nationally, the facilitator coordinates the development of pest alerts. Two pest alerts were developed during this reporting period (West Nile Virus National Pest Alert and Multicolored Asian Lady Beetle Pest Alert). In addition to the pest alerts, a Multicolored Asian Lady Beetle Watch web site was developed to allow individuals to report infestations of this pest as it searches for over-wintering sites. Data

obtained from these reports will be used to assist researchers in developing new control recommendations.

- b. Impact - With the cooperation of the facilitator, many of the objectives of the NCPMC were met. Input from the regional advisory committee was incorporated into regional priorities and objectives. The West Nile Virus National Pest Alert was initiated prior to the outbreaks of 2002. This proactive approach enabled IPM coordinators and extension personnel to acquire a supply of the fact sheet in preparation for a potential outbreak in their state.

A total of 70,000 printed copies were distributed and hundreds of copies of the electronic pdf version (<http://www.ncpmc.org/NewsAlerts/2002WestNileAlert.pdf>) were made available as a public document. The Multicolored Asian Lady Beetle National Pest Alert (http://www.pmcenters.org/northcentral/MALB/MALB_Fact.pdf) and a companion web site Multicolored Asian Lady Beetle Watch (<http://www.pmcenters.org/northcentral/MALB/>) were developed and released to the public in August, 2002. To date, the Multicolored Asian Lady Beetle Watch web site has received 396 hits. The North Central Regional IPM Grant Program received 72 letters of intent and 49 fully developed proposals in 2001. Of those 49 proposals, nine projects were funded (\$773,644).

- c. Source of Funding – State, USDA Grant Funds
- d. Scope of Impact – National

Key Theme – Forest Resource Management

Long-Term Ecological Processes in Riparian Forests

- a. Two sets of study plots, differing by 400 meters in elevation, were established on the Middle and Ramsay Prongs of the Little Pigeon River, Tennessee. The purpose of the study was to document and monitor all vegetation types, determine the effect of flooding on establishment and survival of tree seedlings, compare the composition of the two study locations, and observe trends in regeneration strategies of tree species.

The two study sites were found similar in composition and diversity, with most plots dominated by rosebay rhododendron (*Rhododendron maximum*). This shrub/small tree limits light and

possibly other resources for all other vegetation types. The current forest canopy and regeneration layer of trees is composed mainly of shade tolerant, high seed-producing species. A few observed "hotspots" that appear to promote herbaceous and tree seedling diversity are depositional bars adjacent to the active river channel, islands in the middle of the streams and rhododendron gaps.

- b. Impact - Knowledge of wood production and biological processes in stream side forests provides important information for better management of these forests for private and public landowners.
- c. Source of Funding – McIntire Stennis, State
- d. Scope of Impact – National

Adaptations of Black Oak to Fire

- a. Two successional forest stands developed on pastureland abandoned during the 1930's in Piatt County, Illinois were examined for patterns of species diversity and composition. These stands are unusual in this region of intensive agriculture because successional processes have not been altered by tree cutting, mowing, fire, or grazing which typically have occurred in other successional forests in the region. The two stands differed in percentage of forest border and configuration at the time of abandonment.

The relationship of distance to forest border with tree species diversity in the successional stands was examined and the species composition and structure of both stands described. Importance values using relative density, basal area and frequency were calculated. The Shannon Index of Diversity and Simpson index of dominance were calculated for both stands using the jack-knifing procedure. A regression equation using jack-knifed values allowed us to quantify a significant increase in diversity with closeness to forest border for the forest stand with less forest border and wider configuration.

The successional stand with a higher percentage of forest border and a narrow configuration was more diverse than the stand with a low percentage of forest border and a wider configuration. *Quercus imbricaria* (shingle oak) had the highest importance value in both stands. *Ulmus americana* and *Ulmus rubra* were also important in

both stands. *Q. imbricaria*'s importance value was almost double that of the stand with less forest border.

Tree species with large seeds had lower importance values in the stand with less forest border. The wind-dispersed species had greater importance values in the stand with less forest border and preferential avian dispersal of *Q. imbricaria*'s small acorns may have facilitated its invasion of old-fields. Only at one site and in the 41 cm and greater size class did *Quercus velutina* (black oak) and *Quercus alba* (white oak) outnumber *Q. imbricaria*, the third most common species. Prior to the abandonment of agriculture on the two sites, *Q. velutina* occurred in old pastures and on the driest ridges in the study locale. The *Quercus* spp. combined made up almost 69 percent of the stems in this size class.

- b. Impact - By extrapolating these results to similar regional sites to be reforested, it will be possible to better predict the likely course of natural forest regeneration. Thus it will be possible to more efficiently enhance and accelerate natural regeneration of forest trees by applying this knowledge to the prescription of planting of desirable tree species.
- c. Source of Funding – Hatch, State
- d. Scope of Impact – National

Developing Methodology for Assessing the Quality of a Process Forest Growth Model on a Spatial Scale

- a. This project was intended to overcome current significant gaps in the use of models for assessment and management of forests and natural resources. Specifically, this project attempted to account for the effect of different sources of error on the uncertainty of the predictions made through different types of process-based forest growth models and empirical natural resource models, and also provided the rationale for efficiently reducing that type of uncertainty. In this project, emphasis has been put on spatial uncertainty as it moves through models.

The methodology developed is relevant to all users of ecological and environmental models. Models are widely used in natural and cultural resources to predict the future state of those systems. These models intend to describe the system underlying mechanisms by accounting for the regulating functional

relationships. Thus, models help us formalize these often complex processes, which would otherwise be very difficult to track. Many of these models are spatially explicit and use inputs that are spatial and are based on remote sensing imagery.

In this project, different methodologies for developing error budgets were developed. Error budgets can be used to assess the quality of the overall simulation system. An error budget can be considered as a catalog of the different error sources that allow the partitioning of the projection variance and bias according to their origins. As a specialized form of sensitivity analysis, an error budget shows the effects of individual errors and groups of errors on the quality of a multi-component model's predictions. The goal in developing the error budget is to account for all major sources of errors that can be expected in a system. By doing this, the sources of errors can be examined and partitioned in different ways. Additionally, an error budget can be generated for different time steps and spatial scales.

We focused on the spatial distribution of prediction uncertainty and the contribution of different error sources to that uncertainty which were spatial explicit. Uncertainty was mapped both in time and space. We employed a number of different types of statistically-based simulation approaches to develop these spatially explicit budgets. The methodological framework we developed in this project included identifying errors, modeling their propagation and accumulation from data collection, image processing and analysis, classification or mapping models, etc., to map products based on predictions, making error budgets and quantifying contributions of the errors to the uncertainties of each map product.

We also provided the rationale for efficiently reducing different types of uncertainty. In terms of future extension of the work, we will focus now on model-based experimentation (virtual experimentation) and on a number of issues related to scales in both time and space.

- b. Impact - Making predictions without analyzing the associated uncertainty may mislead decision-makers as to the quality and reliability of those predictions. Decision-makers should know upfront about the errors and the causes of the errors. Errors and uncertainty will not disappear just because they are not assessed. Decision-makers who will be making decisions based on models

with errors will only realize the errors after the decisions are already implemented. The purpose of this project is to develop methods for assessing uncertainty before models are used to make decisions.

- c. Source of Funding – McIntire Stennis, State, Department of Defense Funds
- d. Scope of Impact – National

Key Theme – Global Change and Climate Change

The Role of Ethylene in Ozone-Induced Damage to Photosynthesis

- a. Atmospheric gases have positive and negative effect on crops. Ozone, for example, has a negative effect on crops. The gas has increased an average of one percent per year and is already estimated to have cost agriculture in the United States over \$2 billion in lost production.

The problems of surface ozone changes are regional, depending in part on proximity to urban and industrial areas. Soybean production in the US corresponds closely to the rural areas most affected by ozone. By contrast, there is little or no elevation of ozone in the soybean growing areas of South America. Concentrations for much of the Midwest and East coast have exceeded thresholds for crop yield reduction in the past years. Because soybean is one of the more ozone-sensitive crops, researchers expect adverse effects on yield and other soybean quality factors if no action is taken.

Carbon dioxide has a positive effect on plants. Carbon dioxide has been increasing at a rate of .4 percent per year. Since plants use carbon dioxide as their source of carbon for photosynthesis and growth, this has been a positive change for plant production. In fact, the rise in carbon dioxide that has already occurred has the potential to increase yields by as much as 30 percent and by 2050 a further potential 30% is predicted. But, those yields are unlikely to be realized with today's soybean, since these varieties appear no better adapted to increased carbon dioxide than varieties from a century ago. Understanding how we can adapt soybeans to take advantage of increased carbon dioxide will not only allow us to realize the potential 30% gain that concentrations of 2050 will

provide, but will also fully realize the 30% allowed by the increase that has already occurred. In essence, adapting the crop to tomorrow will also improve yields today.

A research team at the University of Illinois is conducting experiments that mimic the content of the atmosphere in the year 2050, specifically ozone and carbon dioxide, and how those changes will affect crops.

The project is called SoyFACE - soy, because the project was originally funded to look only at affects on soy. FACE stands for Free-Air gas Concentration Enrichment, which refers to the technique being used to simulate different percentages of ozone and carbon dioxide in the air.

The FACE facility looks like it could be a newfangled field irrigation system. It is actually a network of tubing that delivers different concentrations of ozone and carbon dioxide into the air that surround the soybean and corn plants in the test field. The FACE creates a kind of greenhouse without the walls and glass around it. The higher concentrations of gases dissipate as they rise out of the study area and into the general atmosphere without causing any change to the surrounding area.

The open-air field laboratory gives researchers an opportunity to look at a whole system in a 'real-world' way that is not possible in greenhouses or controlled chambers. After its first two years in operation, researchers have already observed some remarkable variations due to the changes in atmosphere inside the ring. Photos show that the soybeans growing inside the FACE ring in elevated carbon dioxide stayed greener longer than the soybeans growing just inches away, outside of the experimental arena. By contrast, increased ozone caused the plants to turn yellow earlier. Increasing carbon dioxide resulted in a 15% increase in yield in the best cultivars of soybean, while increase in ozone to 2050 levels caused a 15% decrease. There was variation between cultivars showing that there is a basis for improving yields under these changed conditions.

- b. Impact - The effects of atmospheric gases on a cropping system are very complex. Once researchers understand the science behind the changes they can begin to genetically modify the crop or select genotypes and management systems that take advantage of those changes to increase production under levels of atmospheric gases

predicted for the future. In 2002 small areas of Arabidopsis were added to each plot. Arabidopsis is a small plant widely used in science because its DNA or genetic blueprint has been fully unraveled. This has allowed the team to see which genes or DNA becomes active in response to ozone or carbon dioxide. This provides clues as to which genes may be important in soybean.

Once factors that limit seed production and quality under these changed conditions are identified, researchers can use molecular engineering and breeding to develop plants better suited to carbon dioxide levels in the atmosphere today and levels anticipated in the future.

- b. Source of Funding – Hatch, State
- c. Scope of Impact – National

Key Theme – Natural Resources Management

Ecosystem – Based Management for Agricultural and Natural Lands in Illinois

- a. This project continues to provide research results and practical applications for ecosystem-based management in disturbed landscapes. The project focuses on social dimensions of watershed planning and land management. The workbook, “A Step-by-Step Guide to Conducting a Social Profile for Watershed Planning”, was completed in April 2002, and 500 copies have been distributed to watershed planning groups and personnel at the Illinois Department of Natural Resources, USDA Natural Resources Conservation Service, Soil and Water Conservation Districts, the Illinois EPA, the U.S. Army Corps of Engineers, the Nature Conservancy, and various other groups. Demand for the workbook has justified a second printing. A website that accompanies the workbook has also been created and is 90 percent functional with work continuing. The workbook and website provide information and instructions for collecting social data related to watershed planning, suggest data indicators and locations of these data and provide instructions and sample questions for a mail survey of landowners. The website can be accessed at <http://www.watershedplanning.uiuc.edu/>.

These tools and techniques were used to conduct a mail survey that assisted the Hurricane Creek Watershed Planning Committee in

Illinois to identify landowner opinions and conservation attitudes. Survey respondents revealed positive conservation attitudes. Respondents also indicated that they are most concerned about the loss of family farms, eroding streambanks, soil deposition, rural development, and drinking water quality. Responses were frequently split and often a high percentage answered in the 'don't know' category. These results strongly suggest the need for more public information and education about natural resource issues in the watershed.

A more informed public may clarify the varying opinions about the severity of problems, the desired land uses in the watershed and the effectiveness of conservation practices. Two additional surveys are being designed and conducted for the Vermillion River Watershed and the LaMoine Watershed, partnerships in the IDNR Ecosystem Program.

- b. Impact - The explosion of community-based watershed groups (over 100 in Illinois) across the nation reflects the changing social values for natural resource conservation and involvement by the local public. Balancing ecological goals and social goals into a management plan is often a challenge for a watershed-planning group. If landowners are expected to voluntarily implement a watershed management plan, the plan must not only address natural resource issues in the watershed but also consider all management issues relevant to the individual.

In a watershed approach, it can be overwhelming to uncover the needs and concerns of many individually operating landowners. And once these issues may be uncovered, they are often difficult to coalesce and incorporate with biological and production goals of land management plans. At present there are no social scientists on staff with the IDNR to provide this kind of assistance to watershed groups. The Illinois NRCS has one full-time person to assist individuals and groups throughout all of Illinois. The publication of this workbook fills a critical gap in watershed planning and land management. Using the workbook as a guide, watershed groups should be able to collect social data and complete a social profile with very little personal assistance.

- c. Source of Funding – McIntire Stennis Funds
- d. Scope of Impact – Illinois

Governor’s Conference on the Management of the

Illinois River System

- a. University of Illinois Extension works cooperatively with local, state and federal agencies as a joint sponsor of the Governor's Conference on the Management of the Illinois River System. One of the 2004 conference co-chairs was U of I Extension Educator, Bob Frazee. Frazee has held the co-chair position for several of these conferences since they began in 1987. Nearly 400 people attended the 2003 conference.

An all-day conservation tour began the three-day conference. Participants visited a farm managed for wildlife habitat, the Peoria Lock and Dam, the Greater Peoria Sanitary District, a barge-fleeting operation, Brownfield Redevelopment, and a riverfront development.

Keynote speakers included Illinois Lt. Gov. Pat Quinn and Lt. General Robert B. Flowers, Commander and Chief of Engineers, US Army Corps of Engineers, based in Washington, DC. Flowers referred to rivers as both highways and habitats and emphasized the Corp's attention to balancing those interests. The group also heard speakers discuss the huge jump in the numbers of invasive Asian carp in the Illinois River and measures being taken to keep them from reaching Lake Michigan. Other speakers told of opportunities within the 2002 Farm Bill that could benefit the Illinois basin.

Studies done over the past 150 years provide a tremendous knowledge base regarding the Illinois River, observed Dr. Richard Warner, Director of the Illinois-Indiana SeaGrant Program, and luncheon speaker. He said the challenge is to connect the Illinois Valley to the future of the nation.

The group also learned of various collaborative projects including a decision support system that's helping organize information gathered by a variety of agencies. River issues being addressed include erosion and sedimentation, water quality, floodplain management, habitat restoration, agricultural practices, commercial navigation, Lake Michigan diversion (which is at its lowest rate ever), and municipal and industrial waste discharge. Eco-tourism and its potential for economic development was also discussed.

This was the ninth biennial conference, continuing a tradition begun in 1987 to bring together representatives of local, state and federal agencies, groups and individuals for news of research, management techniques and initiatives to protect and improve the Illinois River. The conference opened with talks by directors of state and federal agencies involved with the river, or their representatives. More than 60 groups were involved as cosponsors.

- b. Impact - About nine out ten of those responding to the evaluation rated as either good or excellent the "diversity of topics," "educational value of the presentations," "the networking opportunities," and "the overall conference." Other impacts from the conference would include sustaining and improving levels of the cooperation needed between organizations and individuals to solve problems related to the river system.
- c. Source of Funds – State, Federal
- d. Scope of Impact - Illinois

Key Theme – Nutrient Management

Also see Biophysical Models for Poultry Production Systems listed under *Key Theme - Animal Production Efficiency*.

**Farm and Watershed Level Policy Analysis:
Agro-Environmental Implications**

- a. Research in three areas was undertaken. The first area examines the profitability of site-specific technologies (SSTs) for fertilizer application as an alternative to conventional methods where fertilizer is applied uniformly across the field. We developed a model of farmer decision-making to determine the extent to which uncertainties about soil fertility and weather affects the value of site-specific technologies (SSTs) using jointly estimated risk and technology parameters. We find that uncertainty can lead risk-averse farmers to apply more fertilizers and generate more pollution than in the certainty case. Ignoring uncertainty and risk aversion would overestimate the economic and environmental benefits of SSTs and underestimate the subsidy required to induce adoption. Accounting for uncertainties and risk preferences might explain the low observed adoption rates of SSTs. Improving the accuracy of SSTs would increase the incentives for adoption. We

are also conducting on-field experiments on ten fields at various locations in Illinois to gather data to estimate a spatially sensitive yield response function that will be used to examine the optimal rate of uniform and variable rate application of nitrogen in fields. These optimal rates will then be used to determine the profitable management strategies for fertilizer application in Illinois.

We are also examining the strategies to optimally select the land to be enrolled in the Illinois Conservation Reserve Enhancement Program (CREP). We developed an integrated framework of economic, environmental and GIS modeling to study cost effective retirement of cropland within and across multiple watersheds to achieve environmental goals. This framework is applied to several agricultural watersheds in CREP's eligible region. The characteristics of land parcels to be targeted for retirement within each watershed and the criteria for cost effective allocation of abatement responsibility across watersheds are analyzed. The costs of abatement with a uniform allocation of abatement responsibility across watersheds and the ensuing pattern of land retirement are compared to those with the least cost approach.

In the third area of research we are examining the economic costs of various policies designed to promote ethanol and the environmental effects of an expanded national ethanol program. We are developing an economic model of gasohol, gasoline, ethanol, and corn markets that will include calibrated demand and supply curves for each of these markets. Applied welfare analysis is being used to determine the economic impact of various policy scenarios on consumers, corn farmers, taxpayers and on the environment.

- b. Impact - Our research on site-specific crop management will enable a determination of the optimal uniform rate of application as well as the economically optimal way to vary nitrogen application rate within the field. The relatively large number of fields at which experiments will be conducted will enable the researchers to generalize their results to other fields in Illinois. Software being developed at the University of Illinois will enable researchers and eventually farmers to very inexpensively determine the economically optimal variable nitrogen application rates for their fields.

The findings of our research on CREP are useful to the Illinois CREP Advisory Committee, the Farm Service Agency, and the

Illinois Department of Natural Resources who are developing criteria for targeting land parcels for enrollment in the program. The findings of this research are also of interest to the USDA as it is considering mechanisms for improving the design and targeting of the Conservation Reserve Program. Our research on ethanol will enable us to develop recommendations for how corn, ethanol and gasoline policies could be changed simultaneously to make all interested groups better off.

- c. Source of Funding – Hatch, State, National Science Foundation Funds
- d. Scope of Impact – Illinois

Assessing Nitrogen Mineralization and Other Diagnostic Criteria to Refine Nitrogen Rates for Crops and Minimize Losses

- a. Prior research showed that corn response to nitrogen (N) fertilizer is low on some fields, particularly on fields that have a history of N application at rates well in excess of those recommended by the University of Illinois. This led to the theory that excessive N application may result in the accumulation of organic N in the soil that is mineralized at a faster rate for succeeding crops.

Recent research indicates that accumulation of amino sugar N in soil reduces the yield response of corn to N fertilization. A simple technique was developed to estimate amino sugar N. Comparative studies using 12 nonresponsive and 13 responsive soils showed a very high correlation between soil-test N and amino sugar N. The objective of this project was to correlate the new test with crop yield response to fertilizer N on farmer fields. This new soil test accurately identified 6 of 14 sites as being non-responsive. Unfortunately, one site identified as being nonresponsive to N was very responsive. Data are being processed to determine if the test will predict actual N need on those fields that are projected to be responsive to N.

- b. Impact - Results of this research will be used to educate farmers that use of the recommended rate of nitrogen fertilizer application will result in greatest income and lowest potential for environmental contamination.

- c. Source of Funding – Hatch, State, Multistate Research, Other Non-Federal Funds
- d. Scope of Impact – CA-D, IA, IL, IN, KS, MI, MN, MO, NE, OH, SD, WI

Illinois Certified Livestock Manager Training Program

- a. Thanks to legislation passed in May 1997, larger livestock operations in Illinois are required to have a certified livestock manager and a livestock manure management plan. Working with the Illinois Department of Agriculture and livestock commodity groups, University of Illinois Extension developed a training package to enable producers to develop plans to protect water supplies and become certified. A major part of this training is being a good neighbor and making sure that surface runoff and odors are controlled. Attitudes of both producers and neighbors are changing and U of I Extension is working hard to see that attitudes of both are changing for the better, not worse.

Questionnaires were mailed to 500 participants on March 28, 2003. Five were returned with “bad addresses.” By May 27, 347 usable questionnaires had been returned for an overall response rate of 71.1 percent.

Many of the participants were being "recertified" meaning that they had been previously trained and may have already made improvements in their operations.

- b. Impact – By practice area:

Nutrient Management Plan – 70-80 % had done prior.

Done as a result of the workshop varied from 2.9% to 4.3% while "planned to do" ranged from 7.5% to 14%.

Manure Nutrient Analysis – Done as a result ranged from 5.9% to 9.9% with plan to do ranging from 34.8% to 40.1%

Changes in Water Protection – Done ranged from 1.0% to 5.8% and plan to do ranged from 10.0% to 28.7%

Over the range of six topic areas – 30 % indicating making one or more changes with 75.5 % planning changes.

- c. Source of Funding – Federal, State, Fees
- d. Scope of Impact - Illinois

Illinois Certified Livestock Manager On-Line Training Program

- a. University of Illinois Extension has been providing training for livestock manager certification since 1997 through face-to-face programs and printed material. Recently, Illinois has begun to offer "credit" for attending training on-line. To receive this credit participants need to pass timed, on line quizzes.

A total of 111 people volunteered to pilot the quizzes. Mail questionnaires were sent to a random sample of 100 of the volunteers for the quiz program during the summer of 2003. Five of the addresses proved to be undeliverable. A total of 50 useful questionnaires were returned for a response rate of 52.6 %.

- b. Impact - Most of those responding indicated they wanted to try the on-line because they felt it would be "convenient" and like the idea being able to do it from the home, office or other location.

Of those responding, 82% completed one or more of the quizzes. Seventy-five per cent used a home computer and 25% used a computer at their work office or through an Extension office (three responses).

Ninety-five percent reported no problems in getting or staying connected on-line while taking the quiz. Forty-two percent reported being very comfortable and 45% comfortable using a computer. A total of 82 % reported being very comfortable or comfortable using the internet.

Eighty-seven percent said they would try the on-line approach to become certified in future years.

Ninety percent would recommend this approach to other producers.

- c. Source of Funding – Federal, State
- d. Scope of Impact - Illinois

Key Theme – Pesticide Application

Commercial Pesticide Applicator Training

- a. Commercial pesticide applicators are required to be certified and to be recertified every three years. University of Illinois Extension works cooperatively with the Illinois Department of Agriculture to provide training clinics for both private and commercial pesticide applicators. University of Illinois Extension's stake in these clinics extends beyond merely enabling the participants to pass the examination. These clinics are used to promote safe practices and best practices in pesticide application.

During the spring of 2003, a sample of 500 participants in that spring's training clinics were asked to complete a mail survey. Fifty-one percent responded.

- b. Impact – Participants were asked about 15 key practices for environmental and personal safety. Ninety-three percent reported making some or great improvement in at least one practice. More than 80% reported improvement on five or more practices. Specific practice areas where participants improved (some or great improvement) included:
 - 67.5 % - Pest control decision-making (IPM techniques)
 - 67.4% - Including non-chemical methods of control
 - 66.3 % - Identifying environmentally sensitive areas before making a pesticide application
 - 65.6 % - Increasing the frequency of calibration
 - 63.1 % - Application procedures (relating to accuracy, uniformity, drift)
 - 61.1 % - Calibration procedures

Generalizing these results to the 24,296 applicators trained between 2001-2003 means that more than 19,000 applicators improved on **five or more** practices.

- c. Source of Funding – Federal, State
- d. Scope of Impact – Illinois

Private Pesticide Applicator Training

- a. University of Illinois Extension provides training to individuals taking the state test for licensing to buy and use restricted use

pesticides in their farming operations. In addition to helping to provide the knowledge necessary to pass the examination, the training clinics stress wise and safe use of pesticides. During the 2002/2003 program year training was provided to 8,096 private applicators who attended a total of 120 clinics.

- b. Impact – Participants at 20 clinics were asked to complete an end of session questionnaire. A total of 1,437 were offered the opportunity to complete the questionnaire and 77 % (1,104) responded.

Between 94 to 95% responded to the following statements with *agree* or *strongly agree*:

I will utilize integrated pest management techniques and rotate pesticides to help improve pest control and avoid pesticide resistance.

I will take the time to read and follow the label directions before making any pesticide application.

I will utilize personal protective equipment and follow proper pesticide storage and disposal procedures.

I will identify environmentally sensitive areas prior to making a pesticide application and will take necessary precautions to avoid contaminating and damaging these areas.

I will calibrate my application equipment and will adjust, repair, or replace components to ensure accurate pesticide applications.

I believe that my actions as a pesticide applicator will affect the future availability of pesticides.

If we generalize these findings to the 8,096 2002/3 participants, 7,610 producers will adopt more environmentally sensitive and safer pesticide practices.

- c. Source of funding – Federal, State

- d. Scope of impact - Illinois

Reducing the Potential for Environmental Contamination by Pesticides and Other Organic Chemicals

- a. Over the past 11 years, flow and water quality data has been collected at river stations and from tile systems in the Little Vermilion River (LVR) watershed in Champaign and Vermilion Counties in east-central Illinois. Those data include concentration and calculated load for selected nutrients and pesticides. Hydrologic model modules to represent drainage systems are being developed, and existing models modified, to ensure that the effect of extensive drainage, such as that occurring in the LVR watershed, is properly represented by the models.

While the hydrologic response and nutrient transport components of such work is attributed to other projects, the pesticide transport component development work is being undertaken by this project. Collaborative work between the University of Illinois and Purdue University is utilizing the data set to develop sampling frequency criteria for water quality research projects. It is anticipated that results will include guidelines for monitoring projects in support of Total Maximum Daily Load (TMDL) development to gather meaningful data under budgetary constraints.

- b. Impact - Impact of the current work under this project is to increase the quality of model representation of drainage effects on pesticide transport along with an increase in the quality of nutrient and pesticide water quality data collection. Availability of funds is always an issue when developing a monitoring program. This project will provide guidance to collect enough data to be meaningful, but not more than is necessary, so that funds can be expended efficiently.
- c. Source of Funding – Hatch, State, Multi-State Research Funds
- d. Scope of Impact - AL, AR, AZ, CA-B, CA-D, CA-R, CTH, DE, FL, GA, HI, IA, ID, IL, IN, KS, MI, MN, MT, NV, NYC, SD, TN, TX, WA

Biocontrol of Soilborne Pathogens

- a. Mycoviruses, viruses that infect fungi, have been studied in several plant pathogen systems, and in some cases they affect the

pathogen's ability to cause disease. The objectives of this research are to screen fungal pathogens of soybean for the presence of double stranded RNA mycoviruses, to determine if any detected mycoviruses positively or negatively affect the pathogen's ability to cause disease on soybean, and to characterize the dsRNA viruses that are present.

Fungal isolates are screened for the presence of mycoviruses through a process of extracting and detecting double stranded RNA (dsRNA). Because fungi do not normally produce dsRNA, any detected dsRNA is believed to indicate infection of that fungus by a mycovirus. Twenty nine of the 44 isolates (66%) of *Fusarium solani* f. sp. *glycines* (Fsg), the causal agent of sudden death syndrome of soybeans, were found to contain dsRNA fragments ranging in size from 1.9 to 11 kilobase pairs (kb) in size.

To evaluate the effects of these dsRNA mycoviruses on the ability of the pathogen to cause disease, several Fsg isolates were cured of their mycoviruses using heat or chemical treatments. The pathogenicity levels of the cured isolates were then compared to their infected parental strains through greenhouse tests. Two cured strains of one isolate show a significantly higher level of pathogenicity when compared their parental strain. However, this difference was rather small, and the pathogenicity levels of the cured strains of two other isolates were not significantly different from their parental strains. We have concluded that the dsRNA mycoviruses detected so far in *Fusarium solani* f. sp. *glycines* do not have a major impact on the ability of this pathogen to cause disease in soybean.

- b. Impact - With increased concerns about the environmental impact of chemical pesticides and the general lack of control strategies for many soilborne, root infecting plant diseases, the development of biologically-based disease control strategies offers many advantages. In this research, we are determining the effect of mycoviruses, viruses that infect fungi, on the ability of plant pathogenic fungi to cause disease. Such viruses have the potential to be used as biological control agents if they suppress the pathogenicity of the fungi they infect.
- c. Source of Funding – Hatch, State, Multi-State Research, Industry Funds

- d. Scope of Impact – IA, IL, IN, KS, MI, MN, ND, NE, NJ, NYC, OH, WI

Key Theme – Soil Erosion

Streambank Stabilization

- a. Streambank erosion is increasing in severity due to greater volumes of surface water runoff from agricultural and urban areas. Such erosion can reduce the amount of tillable crop land while adding to the sediment load of creeks, rivers and other waterways.

University of Illinois Extension workshops focus on training agricultural producers and individuals from conservation agencies and engineering firms on cost-effective methods to stabilize eroding streambanks.

- b. Impact - Within six months of attending one of two workshops held in 2003, 19 participants reported stabilizing 124 severely eroded streambank sites totaling approximately 56,400 feet (more than 10.5 miles.)
- c. Source of Funding - Federal, State
- d. Scope of Impact - Illinois

Key Theme – Soil Quality

Surface Chemistry Of Oxidized and Reduced Clay Minerals

- a. The oxidation state of iron (Fe) in the crystal structure of smectite clay minerals profoundly alters their physical-chemical properties. Among the properties affected are layer change, cation exchange and fixation capacity, swelling in water, particle size, specific surface area, layer stacking order, magnetic exchange interactions, octahedral site occupancy, surface acidity, and reduction potential. Also affected is the surface chemistry of the clay, which alters clay-water and clay-organic interaction mechanisms. Rates and extents of degradation of pesticides are increased in the presence of reduced smectites compared to oxidized and reduced-reoxidized counterparts.

An hypothesis regarding the mechanism for Fe reduction in clay minerals was first developed in 1963, and subsequent modifications have been proposed periodically through the present time. Recent studies clearly reveal that the process of Fe reduction involves more than the mere transfer of an electron to octahedral Fe(III) in the clay crystal. Ancillary reactions occur which produce significant structural modifications, some of which are reversible and others which are not. Such changes in the crystal-chemical environment of structural Fe are thought to play a dominant role in altering the clay surface chemistry.

The effects of Fe oxidation state on the infrared (IR) spectra of dioctahedral smectites were studied using a purified and sodium-saturated fraction of the Garfield nontronite reference clay. The nontronite was first reduced with sodium dithionite for a period of 10 to 240 minutes to obtain various Fe reduction levels. The reduced samples were then reoxidized by bubbling O₂ through the suspensions for 8 to 12 hours. IR spectra of the initially unaltered, reduced, and reduced-reoxidized nontronites were collected. After reduction, changes were observed in the spectral regions of O-H stretching, O-H deformation, and Si-O stretching, indicating that the clay structure was significantly modified beyond merely a change in Fe oxidation state.

Furthermore, a new component band in the O-H stretching region of the reduced samples exhibited a pleochroic effect, indicating the possible existence of trioctahedral domains. A large (up to 43 wavenumbers) downward shift of the main Si-O stretching band of the reduced samples was also observed. Such a large shift indicates

that the change in Fe oxidation state in the octahedral sheet strongly affects the structural properties of the tetrahedral sheet, which might further affect physical and chemical properties of the mineral surface. The spectral differences across all three studied regions between unaltered and reoxidized samples after up to 240 minutes of reduction indicated that the redox process involving sodium dithionite is in some respects irreversible, even though virtually all structural Fe(II) can be reoxidized. Further structural information is being gathered using other physical-chemical techniques, including Mossbauer spectroscopy and X-ray absorption spectroscopy.

- b. Impact - The clay minerals control a large fraction of the chemical processes taking place in the soil. Changes in the electrical charge (oxidation state) of iron in these ubiquitous soil minerals occurs readily in the soil through bacterial activity over short periods of time, causing significant modifications in the underlying chemical behavior of the soil. Understanding the associated changes in mineral structure, chemical composition, and surface reactions provides the basis for predicting more accurately the sustainability of certain cultural practices in the field, including fertilization and pest-control strategies.
- c. Source of Funding – Hatch, State, National Science Foundation, Department of Energy, USDA Grant Funds
- d. Scope of Impact - National

Tillage Impacts on Depth Distribution and Storage Capacity of Young Soil Organic Matter (SOM)

- a. The aim of this project was to understand why use of no-tillage practices fails to increase C sequestration in some Illinois soils. The rapid shifts in particulate organic matter (POM) distribution that have resulted from use of no-tillage practices in Illinois reflect dramatic changes in the quantity, allocation and conservation of young soil organic matter (SOM).

Laboratory Incubations: Long-term incubations are being conducted to assess the sizes of active, slow and passive pools. Comparison of ground and intact aggregates obtained from dry-sieving will reveal structural controls over dynamics. Short term incubations show that C mineralization rates are maximized at higher moisture contents in larger sized aggregates and that longer

incubation times will be required to recover relevant coefficients for C pool estimation under drier conditions.

Field Experiments: The main field study was conducted during the 1999-2002 growing seasons in the corn phase of a corn soybean rotation at three locations where conventional (CT: moldboard and chisel plow) and no-tillage (NT) practices have been in place since 1985 and have had variable effects on SOM balance. Soil CO₂ evolution patterns have been consistent with SOM contents of the three locations. In sites where CT soils have equal or lower SOM contents than NT plots, average and total soil CO₂ evolution from CT plots was greater than from NT plots. At 'aberrant' sites where NT soils have lower SOM contents than companion CT plots, the linear coefficient describing spring efflux rates phase was higher in NT plots.

Site and tillage based differences in CO₂ mineralization have been related to soil physical factors using a variety of statistical and modeling techniques. Inclusion of penetration resistance in the basic Q10 model improved model robustness. Lower bulk density and higher moisture content appear to explain C efflux patterns and thus SOC concentrations in typical and aberrant sites. These results have been used to test a model of macroaggregate-protection influencing the dynamics of loose particulate organic matter (LPOM), occluded particulate organic matter (OPOM), and humified materials (HF). We assumed that LPOM is not physically protected; that aggregate dry mean weight diameter (DMWD) regulates OPOM dynamics and DMWD and clay control HF dynamics. The importance of macroaggregate protection in SOM dynamics varies with sites and is related to temporal CO₂ efflux patterns but may have little relevance to long-term C sequestration.

In a separate field study, root contributions to SOC have been assessed with ¹³C/¹²C at a site where CT and NT practices maintain similar SOM contents in the upper 30cm. Soil δ¹³CO₂ composition is less depleted in CT than in NT soils, suggesting that corn root contributions to soil CO₂ may be greater in CT soils. The relatively high δ¹³C-value of LPOM accounts for the δ¹³CO₂ signatures in CT soils. Seasonal changes in δ¹³CO₂ are more apparent in NT plots. Cropping season CO₂ efflux is greater from NT than from CT plots. Sampling in 2001 was extended to include plots planted to corn and soybean and the isotopic composition of CO₂ dropping notably under soybean.

- b. Impact - This work suggests that soil physical factors influencing C mineralization and not root growth determine whether or not soils accumulate C under no-tillage management. Results are expected to have direct influence on management practices and policies developed to influence those practices in the Midwest. Experimental methods we are working to improve are expected to have applicability to all research addressing soil organic matter management and prediction of C equilibrium.
- c. Source of Funding – CSREES Grants for Research Funds
- d. Scope of Impact – National

Key Theme – Sustainable Agriculture

Control of Animal Parasites in Sustainable Agricultural Systems

- a. Our laboratory researches *Neospora caninum*, a protozoal pathogen that is transmitted between cattle and dogs, and is a cause of bovine abortion. W-102 funds are used to finance preliminary studies, under-funded studies, and aspects of neosporosis research for which we have been unable to obtain funding from other sources.

This year, W-102 funds have been particularly useful for investigation of the *Neospora caninum* life cycle in wildlife. We hypothesize that *N. caninum* is a common parasite of wild ruminants and wild canids, and that these animals are an important reservoir that serve to infect domestic animals. During the hunting season, we obtained discarded deer heads at a meat processing facility, together with clotted blood from the carcass. Heads from four seropositive deer were fed to dogs, and two of these dogs shed *N. caninum* oocysts, with the species identity confirmed by PCR. In addition, we used W-102 funds to pay for publication of essential color photographs in a recent article. This manuscript gives details about in vitro stage conversion of *Neospora caninum*, and provides evidence that tissue cysts do not arise from conversion of established parasitophorous vacuoles.

- b. Impact - Isolation of *Neospora caninum* from deer is important new information that proves the existence of *N. caninum* in wildlife. We are unaware of any previous isolation of this organism from wild animals. Consideration is needed about how

interactions between wildlife and domestic animals may affect management recommendations to reduce the risk of neosporosis in cattle. Knowledge about the process involved in stage conversion of protozoa, such as documented in the publication listed below, may enable future treatments to prevent formation of protozoal cysts in tissues of animals and humans, or treatments to remove such cysts, or production of vaccines that contain the appropriate, orally-infectious protozoal stages.

- c. Source of Funding – Hatch, State, Multi-State Research Funds
- d. Scope of Impact – AZ, CA-D, CA-R, GA, IL, KS, LA, MN, MO, MS, MT, NYC, TX, UT, VA

Key Theme – Water Quality

Outcomes of Nitrogen Fertilizer Management on Tile Drained Watersheds

- a. We have continued measurements of river nutrient concentrations and determining the total loss of nitrogen in all four study watersheds in central Illinois, as well as collecting data on nitrogen fertilizer use and crop yields. Studies on in-stream processing of nitrates have also been made and suggest that retention time is too short to remove significant amounts of N (although denitrification rates are high). The BASINS/SWAT simulation model is being used to estimate impacts of various reduced fertilizer scenarios and other weather regimes.

A challenge has been that farmer participation was not as high as was expected in many of the watersheds, and even where participation was strong, only small reductions in N fertilizer application were documented. Producer and third party focus groups are being planned to better understand why farmers did and did not participate, and if any change in their use of fertilizer has continued after the end of the subsidy program. Results will be used to develop new outreach materials for farmers.

- b. Impact - A better understanding of how Illinois farmers determine their use of nitrogen fertilizer, and what approaches might work to change behavior so that recommended application rates are followed. If fertilizer rates can be lowered to recommended amounts, reduced concentrations of nitrate in surface waters and reduced export of nitrogen to the Mississippi River should occur.

- c. Source of Funding – State, CSREES Grants for Research Funds
- d. Scope of Impact – Illinois

Vegetative Filter Strips Help Control Pathogens in Drinking Water

- a. In 1993, 400,000 Milwaukee residents were stricken with Cryptosporidiosis, a disease caused by the parasite *Cryptosporidium parvum*, also known as Crypto. Forty-seven people died. In 2001, 26 people were infected at a water park in East Peoria, Illinois. In both cases, contaminated water was the likely source of infection.

Crypto is a pathogen that young livestock shed in their waste. The dormant form is called an oocyst. It is very small, with a tough outer shell, and has the ability to withstand all kinds of environmental extremes. It is also one of the most resistant parasites to water chemical treatment. An infected animal can pass as much as 10 billion oocysts per gram of feces, and only a few infected animals can produce enough oocysts to contaminate a large water source.

University of Illinois researchers are experimenting with vegetative filter strips to control Crypto at its source - near animal confinement facilities. Originally designed to be used at the edge of fields to buffer waterways, these filter strips were found to be very beneficial in keeping sediments and chemicals (nitrogen and phosphorous) from getting into streams. Now researchers are testing filter strips for several variables (including soil type and grass species) to determine if they can contain or reduce Crypto.

- b. Impact - Laboratory experiments have shown that vegetative filter strips can significantly reduce Crypto levels in surface water and in subsurface flow. Because Crypto adsorbs moderately strong sediments, filtering sediments through vegetation reduces the transport of the pathogen to all water sources.

Furthermore, when soil was separated into silt, clay and sand particles, it was determined that clay soil, with a larger surface area, acts as the best filter, followed by silt. Field tests showed that Crypto did not adsorb well with sand, which was contradictory to previous tests based on mathematical modeling.

Ultimately, researchers will use this information to define the optimum design parameters for vegetative filter strips to control pathogens coming from animal confinement facilities.

- c. Source of Funding – Federal, State
- d. Scope of Impact - National

Enhancing Disease Resistance in Grasses

- a. Research studying the inheritance of resistance in tall fescue to gray leaf spot caused by *Pyricularia grisea* was completed and submitted for publication. We found that genes responsible for resistance to this disease are likely controlled by many genes in an additive mode of inheritance. We also evaluated U.S. perennial ryegrass collections and commercial varieties for gray leaf spot resistance. The genetic population used in the tall fescue study was also used to study Rhizoctonia blight resistance. After creating and evaluating the disease response in this F2 population, we have created an F3 population which we are currently studying. Lastly, a creeping bentgrass population is being evaluated for resistance to dollar spot caused by *Sclerotinia homoeocarpa*.

As a supplement to this research, we are in the process of determining if pathogenic races of this fungus exist when tested against a representative group of host differentials. Our ultimate goal is to create populations that will allow for genetic mapping of the locations of genes controlling disease resistance in grasses.

- b. Impact - The environmental impact of pesticides and fertilizer application have been questioned due to the potential downstream effects they have on water quality and, eventually, human and animal health. In addition, the advances in genetics have given us tools to get more out of our crops with fewer inputs. This reality is becoming evident with increasing research on small grasses used for forage and turf. Disease resistance is a key feature targeted in this research. We expect our contribution to the development of disease resistant germplasm and the isolation of genes controlling resistance will result in lower management costs and improved environmental impact.
- c. Source of Funding – Hatch, State, Other Non-Federal Funds
- d. Scope of Impact - National

CSREES GOAL 5 – Enhanced Economic Opportunity and Quality of Life for all Americans

Indications of the Scope Research and Extension Programs under Goal 5 - See Appendix A

The College has 48 research projects under Goal 5 which involve more than 21 scientist years and almost 51 staff years of professional and technical support. University of Illinois Extension had more than 1.1 million face-to-face teaching contacts classified under this goal.

Key Theme – Aging

The Effects of an Aging Population on Rural Places and People

- a. There were three major project outputs, two of which will appear as chapters in a forthcoming book.

Research on older immigrants into a rural community shows that levels of involvement in destination communities varies by type of household (alone or living with another), gender and prior presence of friends or relatives in the area. Research on older farmers shows they are less likely to adopt recent innovations (use of the Internet, GPS, Value-Enhanced Grains) or join any of several types of producer organizations. Demographic research on the elderly (and Hispanic) population growth (1990-2000) shows that the concentrations of older persons have shifted to the more urban (metro) areas.

The most rural countries (non-metro, non-adjacent) of the Midwest continue to have the highest proportions of persons 65 and over, and most urban (metro) have the lowest. The proportion of Hispanic in the most rural countries more than doubled, from .7% to 1.6, but is still low compared with the 4.9% overall in the region.

- b. Impact - Older persons are in fact moving into many rural communities. They are, however, not an undifferentiated group. Some are male/females, live alone/in a multiple-person household, have/don't have relatives nearby. These factors influence their level of involvement in the destination community. If conditions are favorable, in just a few years older immigrants are participating at the level of long-term residents.

With respect to farmers, older producers don't have either a strong inclination to innovate technologically or organizationally. That is, they are less likely to participate in guilds, alliances or new Generation Cooperatives. Finally, some of the more noticeable increases in the elderly population are in metro/urban areas and areas adjacent to urban centers.

- c. Source of Funding – Hatch, State
- d. Scope of Impact – National

Key Theme: Agricultural Financial Management

Also see Illinois Farm Management 2003 (FAST) Workshops listed under *Key Theme - Agricultural Profitability*

Farm Bill Decisions Program

- a. The 2002 USDA Farm Program required farmers to make complex decisions, unseen before in previous farm programs. The team responded to the need of our clients to assist in understanding the program and aiding them in the calculations required in program analysis.

Iowa State University developed an Excel spreadsheet that was modified for Illinois farmers. Extension Specialists and staff at the University of Illinois campus adapted the spreadsheet for the specific needs of Illinois farming operations. Farmers or agribusiness professionals entered data supplied by marketing records and the USDA Farm Service Agency for individual farm operations. The spreadsheet projected dollar outcomes among the different options from which the landowner or farmer could choose. The spreadsheet was recognized as the tool of choice for farm operations in Illinois.

Armed with the “2002 Farm Decisions Spreadsheet” and information from the USDA Farm Service Agency, the FBMM Team set about the task of informing and educating farm operators and landowners about the Farm Program.

Through direct methods, the FBMM Team from September 2002 to March 2003 achieved the following contacts:

- General Information Meetings in conjunction with other agencies: 705 individuals attended

- Computer Classes for use of spreadsheet: 61 classes, 569 individuals attended
 - One-on-one consultation: 125 individual appointments
- b. Impact - Over 700 farmers had personal contact with a member of the FBMM Team. Extrapolated from a sample group, the impact for these 700 farmers is between \$18.5 and \$20.5 million in additional income for this group. In addition, the “2002 Farm Decisions Spreadsheet” was made accessible to thousands of farmers and landowners through the “Farmdoc” website.
 - c. Source of Funding – Federal, State
 - d. Scope of Impact – Illinois

Rural Community Impacts of Structural Changes In Farmland Leasing

- a. Consolidation of ownership and operation of farmland, increased absentee land-ownership fueled by high commodity payments and suburbanization of small towns are structural trends fundamentally altering the community context in which rural people are growing older. A controlled comparison research design is in the data collection stage. Twenty-eight interviews have been carried out (approximately half the projected sample size) in central Illinois among the elderly in an historically tight-knit farming community of German ethnicity, and the elderly in a Protestant U.K. ethnic community that has undergone rapid, upscale suburbanization.

In both change scenarios the agrarian community's elderly numbers are contracting leaving the elderly a diminishing proportion of the emerging post-agrarian community. Under these conditions the elderly are finding themselves increasingly less able to support one another in dealing with the challenges of aging and lack kin nearby due to out-migration. Furthermore, because the smaller farms will eventually be sold rather than farmed by heirs, the elderly have lost the traditional leverage over children derived from controlling access to farmland that assured their support.

It is not that the newly emerging post-agrarian communities have fewer people, but that the population composition has changed. The suburbanized town has had a 150% population increase in the past two decades due to the influx of newcomers. The median age is now in the low 30's, much younger than the median age in the

40's typical of an agrarian town. Newcomers, who are living in new subdivisions or buying up old farmsteads are unconnected by choice with the social networks of the elderly population..

Not knowing their neighbors well creates a sense of vulnerability among the elderly, who in addition are unable or unwilling to rely on relative strangers for support. Thus, rural community change, indirectly an effect of agricultural or suburbanization restructuring, has had negative consequences for the well-being of the rural elderly. The elderly in both settings now increasingly feel more isolated and dependent on professionals for the support that formerly was provided by kin and friends. They nostalgically recall when all their neighbors were known and a general level of watchfulness prevailed in the community. For the rural elderly living under diverse change conditions, the outcomes are remarkably similar.

- b. Impact - An unintended consequence of farm consolidation and suburbanization of the Midwest and other rural regions is the erosion through out-migration of those population groups that traditionally cared for elderly, retired farmers. Such community effects of land-tenure change mean that, in formerly farming-dominated communities, neighbors are not involved in the care of the elderly. This population as a group is becoming more isolated. Our rural healthcare delivery policies have not kept up with this rapid change of community supports whether due to agricultural sectoral or suburbanization trends.
- c. Source of Funding – Hatch, State
- d. Scope of Impact – National

Key Theme – Child Care/Dependent Care

Promoting Pro-Social Sibling Relationships Among Young Children

- a. Disagreements between siblings are often seen as a negative part of childhood. In this study, children were taught relationship skills to use with their siblings. The children can then go on to use these skills in their relationships outside the home.

In a research and outreach program, "Fun with Brothers and Sisters," researcher Laurie Kramer found that with instruction, modeling, role playing, and positive feedback, young children can

be taught social skills that facilitate healthy sibling relationships. In this study, four- to six-year-old children with younger siblings were taught six important relationship skills. They learned how to invite their siblings to play, how to accept an invitation to play and how to turn down an invitation. They also were exposed to simple strategies for "perspective-taking" (considering the other's point of view), handling frustration and negotiating conflicts.

- b. Impact - The parents of children in this study noticed improvements in their children's relationships. Highly divisive sibling relationships can be predictive of later problems, such as antisocial and disturbed behaviors in adolescence. Healthy relationships with siblings can enhance a child's social competence in the world.
- c. Source of Funding – Hatch, State
- d. Scope of Impact – National

Neighborhood and Community Factors, Social Support Networks and Preschool Children's Socioemotional Development

- a. The socio-economic development of children plays a role in their successful development as well-adjusted human beings who function well in society.

Data on children's social adaptation and family process were collected on preschool children and their families from the University-affiliated Child Development Lab and preschools in two rural Illinois communities. Data included classroom observation of children's behavior, social network and support interviews, and sociometric interviews of peer acceptance.

Teachers also rated children's behavior using two standard social behavior rating scales. Families also participated in laboratory procedures, home visits and completed questionnaires regarding parenting beliefs and social resources. The combined dataset is now being assembled and analyzed.

The researchers found that how children perceive their social environments is significantly related to their social competence in the classroom setting. Furthermore, the quality of parent-child interaction assessed in the home and characteristics of the neighborhood/community context in which families reside

influence children's socioemotional development. Finally, the ways in which parents structure their conversations with their children about past events is related to the quality of the parent-child relationship and the children's social problem-solving skills.

- b. Impact - These data highlight multiple factors in the family, community and classroom that support the healthy development of children. The information obtained is valuable for both parent and teacher education programs that promote the well-being of children and families. Workshops will be conducted with childcare teachers that focus on issues defined by the teachers as being important in their centers.
- c. Source of Funding – Hatch, State, National Science Foundation Funds
- d. Scope of Impact – National

Key Theme – Community Development

Communication Technologies for Rural Development: An Evaluation of Community Readiness

- a. This research has focused on building knowledge resources and thereby community capacity for economic development by creating Internet-based decision-making tools for rural community development initiatives. The project focuses on how telecommunications can make an impact in rural communities. A series of four focus groups were conducted to explore how the digital divide is perceived and how communities can increase the capacity of local people in using telecommunications technologies. An evaluation workbook was created to assist local leaders in documenting telecommunications innovation and calculating benchmarks to measure their progress toward achieving goals related to community and economic development. The focus group report will provide a more current and relevant definition of "digital divide".

New tools continue to be added to the Community Development Toolbox, such as an eGovernment assessment tool to document how rural communities are integrating telecommunications strategies into local government. The Community Programming for Youth Assessment Index, designed to assess and benchmark the status of youth programming available in the community, will be ready in 2003.

- b. Impact - In the arena of community development, this is the only online, interactive technical assistance and knowledge-building program. For the first time, technical assistance for rural development capacity building is able to reach greater audiences. The overwhelmingly positive feedback from the many presentations and workshops offered in the state and nationally suggests that the Community Development Toolbox is on track and provides community leaders with information that allows them to make more knowledgeable decisions related to community and economic development. In addition, hundreds of communities have accessed our online tools in a meaningful way, tracking their activities online; most users benefit from the interactive nature of the tool.

It is not possible to accurately measure the dollar value of the impact of this toolbox in the short run. For future development, a more comprehensive benchmarking strategy is needed, one that incorporates the less tangible outcomes of this Community Development Toolbox. Furthermore, the research will contribute to a more relevant definition of digital divide - one that goes further than access, but touches cultural aspects of the ability of some people to use telecommunications while others cannot.

- c. Source of Funding – Hatch, State, Other Non-Federal Funds
- d. Scope of Impact – National

Community Swap

- a. Since 1993 more than 170 communities have participated in a U of I Extension Community Swap. Teams of visitors “swap” communities for a daylong visit, where they pose as tourists, prospective business owners, relocating families, or out-of-town shoppers. The teams visit downtowns, business districts, community entrances, neighborhoods, parks, and other public places. Each team later shares its objective impressions of the host community, describing the features which were most attractive and offering suggestions for improvement. The visiting community shares this information through a written report and color slides presented at a town meeting.

This summer, participants in “swaps”, held three-to-five years ago, were asked about what had happened as a result of this program.

The survey was sent out to 44 participants. Twenty-seven were returned making a response rate of 61%. The actual community exchange took place during the years 1999 – 2001. The largest participation took place in the year 2001 with 66% (16). Next, 1999 had 21% (5). The smallest participation was in 2000 with 12.5% (3). n=24

- b. Impact - The respondents explicitly reported that 459 different people were involved in planning the swap and actual exchange. The survey respondents stated that Community Swap influenced the flowing planning events in their community.

n = 27

Influenced Comprehensive Planning	33.3%
Influenced Development or Refinement of Economic Plan	44.4%
Influenced “Operation Main Street” or a Similar Program	18.5%
Anything Else	25.9%
Community Swap has not Influenced Anything	22.2%

In addition, 70% of participants stated something that changed their community because of Community Swap. The most common changes mentioned were “Changes in street signs improved community appearance” and “Better planning tools; we now have an economic development plan”. The most commonly stated use of the data provided by community swap was “Allows us to address our weak areas and take actions to fix them” .

Respondents declared that the most important outcome from Community Swap was “Provided a unique outsider’s look at our community”, & “Awareness of what other people think of our community.” Almost entirely all the respondents (96%) stated that they would recommend Community Swap to other communities. Mostly, respondents recommended Community Swap because it allows “Small communities to pause and reflect about what makes up their communities and how it will thrive in the future” and “Community Swap speaks to the citizens who can make things happen, in small ways, while letting the city’s government know changes is possible”.

- c. Source of Funding – Federal, State, Local
- d. Scope of Impact – Illinois

Festivals and Special Events Workshops

- a. Festivals, fairs and special events are "big business" in many communities. They offer the citizens and visitors alike the opportunity to celebrate, preserve local culture and "showcase" the community as a means of attracting visitors and businesses to the area. Throughout Illinois there are literally thousands of special events that are held annually. These festivals, homecomings and special "holidays" generate hundreds of thousands of dollars into the host communities and help promote the community to future investors.

Special events like fairs and festivals are cause to celebrate and most are the result of endless hours of effort by volunteers and organizations that help plan, promote and carry out the event. Until now, there have been few opportunities for these volunteers to learn more about "how to do the job better" except by trial and error and word-of-mouth.

Workshops are jointly sponsored by University of Illinois Extension, the U of I Department of Leisure Studies, Illinois Regional Tourism Development Councils, local convention and visitors bureaus, Western Illinois University's Recreation, Park and Tourism Administration, the Illinois Arts Council, and the Two Rivers Arts Council.

Since 1992, 2,198 individuals from throughout the state have participated in one or more of the Festival & Special Event Managers Workshops. During the summer of 2002, the U of I Extension Program Planning and Assessment unit conducted a mail survey of participants in workshops held between 2000 and 2002. A total of 198 participants were included in the survey. Eighty-eight questionnaires were received for a response rate of 47.8 percent.

- b. Impact - Based on information gained from participation in the workshop:

65% of respondents indicated the following areas of change.

45% made changes in event planning;

39% made changes in marketing;

37% made changes in how they go about building community support;

31% made changes in their use of the Internet for Marketing;
28 % made changes in their approaches to Grant Writing and Sponsorship;
20% noted expansion in their use of volunteers.

Participants noted a great deal of information sharing with others following the workshops, 82% of respondents indicated that they had shared information gained from the workshops with others:.

57% shared information with local government officials;
40% shared information with either Chambers of Commerce or Convention and Visitors Bureaus;
29% shared information with service organizations;
25% shared information with economic development organizations;
20% shared the information with businesses and the media.

Respondents were asked to indicate the number of people they shared information from the workshop. The number receiving the information ranged from 0 to 300, the average numbers was 26 and the total was 1,710.

86.4 % said they would recommend attending the workshop to other people.

- c. Source of Funds - Smith Lever, State, Local
- d. Scope of Impact - Illinois

Key Theme – Family Resource Management

Your Money & Your Life

- a. Higher-income families have a wealth of information available to them about financial planning through the Internet, financial consultants and others. But, low-income families often operate outside the financial mainstream and lack knowledge about money management practices and financial services. Unfortunately, this lack of knowledge too often results in debt problems, credit abuse

or reliance on high cost financial practices such as currency exchanges and predatory loans.

The Financial Links for Low-Income People (FLLIP) Coalition is comprised of individuals from banks, advocacy groups, government agencies, bank regulators, job training providers, adult educators, and others. The Coalition worked with the Illinois Department of Human Services to form a public/private partnership to provide financial education to help people make sound financial decisions and become more self-sufficient through asset accumulation.

Because of their expertise in teaching research-based financial education programs, University of Illinois Extension's Consumer and Family Economics (CFE) team was asked to be a part of the Coalition. The CFE team received a grant from FLLIP to develop a curriculum that would address the needs of the target audience. Focus groups conducted by FLLIP in seven Illinois sites identified curriculum topics.

The curriculum includes eight lessons. Lessons relate to predatory lending, debt management, saving and investing, and basic financial services. In addition, unlike many financial education curricula, *Your Money & Your Life* includes lessons on public benefits and tax issues that can help low-income persons better understand programs, asset limits and opportunities that may benefit them. Each lesson consists of objectives, background information, participant activities and handouts, teaching guides, and resources. Participant materials are written for low-income, low-literacy-level individuals with an emphasis on examples and activities that are relevant to the audience.

The curriculum was developed as a train-the-trainer program. Persons who work with limited-resource audiences are trained by Extension CFE Educators and then reteach the information in one-to-one or classroom settings. The CFE team has conducted fifteen workshops throughout Illinois for 251 agency and organization personnel.

- b. Impact - Those trained reported a high level of satisfaction with the training and the curriculum.

“The curriculum will help clients set goals regarding money.”

“The training will meet the needs of the community and clients.”

“I’ve learned things that will help me in my personal situation.”
“I will use the information to develop and implement training to assist our clients based on how to budget, manage savings/checking accounts, etc.”

Dr. Steve Anderson, Professor of Social Work at the University of Illinois at Urbana-Champaign was contracted by FLLIP to conduct an extensive evaluation of knowledge gained by the end participant.

The training content, style of delivery, trainer preparation, and trainer presentation scored high with participants who have completed training. (N=356)

96% agreed that the training was not boring
80% agreed that the training material will be helpful
76% agreed that the activities and exercises used were helpful in understanding financial management.

Preliminary findings in follow-up surveys of participants who graduated from the program indicated the following: (N=292)

85.2% did a better job of tracking expenditures
84.3% changed how the household budgets
67.0% changed the way they paid bills
76.5% were very confident they could manage their finances well
24.6% opened a checking account for the first time (of those without previous accounts)
26.0% opened a savings account for the first time (of those without previous accounts)

As is evidenced by the above evaluation data, *Your Money & Your Life* is meeting the goal of helping limited-resource audiences manage their money.

- c. Source of Funding – Federal, State
- d. Scope of Impact - Illinois

A Five-Year Study of the Impact of Welfare Reform on African-American Families and Children in Chicago

- a. This five-year study was undertaken to learn how welfare reform has affected African-American families and children in Chicago.

In the third year of investigation, researchers continued biweekly and monthly visits with families, continued observation of targeted family members in home and neighborhood settings, continued interviews with target family members on key topics (e.g., family life, welfare reform), ongoing qualitative data analysis of field data (e.g., interview and observational field notes), development of inductively-derived theoretical models concerning family processes and economic change for further exploration. Preliminary findings suggest variations in how women are coping with welfare reform. Some women are making the transition to economic independence through employment while others are not. What differentiates women who find employment? And how does employment affect the well-being of adults and children?

- b. Impact - This study will provide insights for policymakers concerned with welfare reform and the well-being of families and children. Key insights will include: What are the characteristics of poor families with children who will be affected by welfare reform? How effective is welfare reform and have its goals been achieved? What are the effects of reform mandates on adults and children? How can welfare reform be targeted to the variable needs of families?
- c. Source of Funding – Hatch, State, Public Health Service Funds
- d. Scope of Impact – Illinois

Key Theme – Promoting Business Programs

Family Business Viability in Economically Vulnerable Communities

- a. While work of the economic sustainability subcommittee has continued to move slowly, the community data are organized and good progress has been made on creating an economic vulnerability scale. The purpose of all these efforts is to develop good understanding of the value of the new data we have and improve our ability to use it to measure the interaction of family and business systems in economically vulnerable and non-vulnerable communities, to identify effects of community structure and characteristics on families and their businesses and to estimate the economic and social contributions of family businesses to

communities over time. Interest in Illinois continues to be on family business policy and employment in family businesses.

- b. Impact - While managers of small family businesses do not indicate that the "unprecedented amount of business-related legislation" passed recently has resulted in significant changes for them, there may be evidence of movement in that direction. It appears that their attention is moving toward increased concern about and emphasis on legal factors and the external environment of their businesses.
- c. Source of Funding – State, Multi-State Research Funds
- d. Scope of Impact – AR, HI, IA, IL, IN, MN, MT, ND, NE, OH, OK, RI, UT, WI

Investigating How Competing Actors Claim Regulatory Gaps in the Privatization of Marine Fisheries: Lessons from South Africa

- a. Concluded second field trip with two students to Cape Town, South Africa during 5 June - 17 July 2002. Gathered empirical data on how fishing corporations, administrators, scientists, industrial, and peasant fishers justified the need for state regulation of the fishing industry. Reviewing the socio-legal literature on theoretical frameworks for interpreting this ethnographic data. Finalizing scholarly article. Contested legalities in the South African marine fishing industry, for publication in the 2003 Law and Society Review. Preparing for the final field trip to Cape Town, South Africa in Summer 2003
- b. This research will contribute to socio-legal knowledge on how law structures and stabilizes social relations in society. Constitutive legal theories, in contrast to instrumentalist approaches, are expected to better explain how regulation matters for societies in transition like South Africa.
- c. Source of Funding – Hatch, State
- d. Scope of Impact – National

Key Theme – Workforce Preparation – Youth and Adult

Welcome to the Real World

- a. "All my expenses cost more than I ever really thought!" is a comment expressed by young people who have participated in the Welcome to the Real World program. This active, hands-on real-life simulation gives young people the opportunity to explore career opportunities, make lifestyle and budget choices similar to those adults face daily. Students then evaluate the choices they have made.

This program puts students into a world of a 25-year-old, single, employed, independent person. The participants make decisions about housing, vehicles, utilities, insurance, entertainment, and other living expenses.

During the Welcome to the Real World program, students explore potential careers they would like to pursue in the future. After they choose a career and then proceed through the "Real World" simulation, deducting taxes, determining a savings amount, and spending their monthly "salary" on the necessary and luxury items that reflect the career and lifestyle they have chosen. Students also learn skills in writing and balancing a checkbook, saving, budgeting, and developing a spending plan.

- b. Impact - An evaluation of this program (involving 635 high schoolers across ages and schools) produced the following results:

Nearly 95% of respondents agreed that the “program was interesting”, “the information was useful”, “the activities were helpful”, and “participating in this program would help me in the future.” Moreover, nearly 80% of the participants stated they had enough money to meet their expenses. Of the 20% who did not meet their expenses, only 50% of them stated that they were surprised at this.

The program also taught valuable life skills. Below are the life skills taught at Welcome to the Real World and what percentages these skills were learned.

Skill	% Already Knew	% Learned	% Learned of Those Not Knowin g
Explore career possibilities n=618	56.1%	43.7%	99.6%
Write a check n=620	80%	20%	100%
Balance a checkbook n=618	68%	32%	100%
Open a savings account n=618	67.6%	32.2%	99.5%
Keep track of savings n=616	68.2%	31.7%	99.5%
Balance income of expense n=617	50.7%	49.3%	100%
Prepare a spending plan n=619	37.3%	62.7%	100%

More than 75% of the students reported learning one or more skills as a result of the program. More than 47% reported learning three or more skills.

Over the past three years 17,920 youth have participated in the Welcome to the Real World simulation.

- c. Source of Funding – Federal, State, Local
- d. Scope of Impact - Illinois

Assessing Job Satisfaction, Training Needs and Stress in Social Service Employees in Food Pantries and Homeless Shelters in Chicago

- a. A survey has been conducted to assess the job satisfaction, training needs, and the stress level in social service workers in food pantries and homeless shelters in the Chicago, Illinois metropolitan area. The same survey has been conducted with workers in the upper end of the hospitality industry working at restaurants and hotels in the Chicago area. The subjects are recent graduates of the Hospitality program at the University of Illinois. A comparison is being made between the two groups. The results of the survey are being analyzed to determine training needs for the social service workers. Classes will then be developed to address these needs.

- b. Impact - Educating inner-city social service workers and para-church employees in the skills necessary to run food pantries and homeless shelters.
- c. Source of Funding – Hatch, State, Other Federal Research Funds
- d. Scope of Impact – Illinois

Key Theme – 4-H Youth Development

Also see, "4-H Can Make a Difference" Under Goal 2 and Welcome to the Real World under this Goal

Methamphetamine and Other Club Drugs

- a. Methamphetamine (Meth) and other club drugs refer to a wide variety of drugs that can cause serious health problems and even death. A number of our nation’s best monitoring mechanisms are detecting alarming increases in the popularity of these drugs. Since 1997, Illinois Law Enforcement has reported increases in Meth-related encounters across the state. In 1997, only 24 labs were reportedly seized in Illinois. This number jumped to 87 in 1998, and in 1999 reached 246. In 2001, the number of seized labs reached 666 and it is projected that the number of labs seized in 2003 will exceed 1,000.

Realizing the need to provide education on Meth. and other drugs to service providers, educators, health departments, social workers, teachers, administrators, and others, University of Illinois Extension organized an initial meeting which included: In Touch-Service Area 14, Prevent Child Abuse Illinois, Triangle Center, and the Illinois State Police to discuss strategies to increase the awareness of the Meth problem. It was determined that the above-mentioned groups would work in a collaborative effort to provide daylong educational workshops in Central Illinois. University of Illinois Extension served as the key presider for the coalition.

- b. Impact - Five programs were organized and presented during 2003 – three in Springfield and two in Bloomington. Over 600 participants completed the daylong trainings of which included case workers, agency administrators, law enforcement, firemen, educators, and others. Due to the popularity of the program, it has been replicated in other Illinois counties.

University of Illinois Extension has been requested by the Attorney General's Office to serve on an Illinois Task Force to address the Meth problem.

- c. Source of Funding – Federal, State, Local
- d. Scope of Impact - Illinois

CSREES Management Goals

Key Theme - Multicultural and Diversity

Urban Extension's English and Spanish Website

- a. Launched in 1996, the U of I Extension Urban Programs Website continues to grow both in terms of the quality and variety offerings and in usage. In 2004, there was a total of 27,261,920 hits. "A 'hit' represents a single page viewed on our website," explained Jane Scherer, U of I Extension Urban Programs Specialist. To better serve Illinois Spanish speaking and reading residents, Spanish language pages were added in 2002. During 2003 a total of 1,81,725 hits were received by the Spanish pages for an average of 155,977 hits per month.

The English pages can be reached at:
<http://www.urbanext.uiuc.edu/index.html>

The Spanish language pages can be reached at:
<http://www.urbanext.uiuc.edu/espanol/>

B. Stakeholder Input Process

Stakeholders provide continuous feedback in terms of programming needs as well as programming results. The College of ACES has many channels for stakeholder input. The College, the Office of Research, the Office of Extension and Outreach, all academic departments, and many programs and projects in the College have advisory councils made up of stakeholders. The advisory councils meet at least yearly, but in many instances more frequently than that, and are active participants in determining the direction of the College units as well as specific programs. Several hundred stakeholders, representing both organizations and individuals, participate in this process on an annual basis.

Stakeholder input is typically oriented towards input in the nature of the decision-making within the units and projects in the College, as well as focusing directly on the results from the College's activities for the stakeholder groups or for the state population at large. Stakeholders who function in an advisory capacity typically do not distinguish between research and outreach outcomes, and they form a powerful voice for the effective integration of research and extension activities.

The Council on Food and Agricultural Research (C-FAR) was organized to increase state funding for food and agricultural research. C-FAR is made up of such organizations as the Illinois Farm Bureau, the Audubon Council of Illinois, the Illinois Dietetic Association, the Horseradish Growers of Illinois, Illinois Rural Partners, and nearly 50 other equally diverse state organizations. While these organizations frequently disagree sharply on specific aspects of agricultural production and policy, nutrition, and rural development, all agree that a results-focused research program will provide a valuable contribution to resolving many of the issues affecting the health of the Illinois population, agricultural production and rural development. C-FAR has been successful in obtaining additional funding from the state legislature to enhance College-based agricultural research at the University of Illinois and other state institutions. Because C-FAR has been willing to expend the effort to increase the support for research it has acquired a significant role in helping to define the research agenda. By focusing continuous attention on the need to solve "real-world" problems and insisting on the timely sharing of research results with constituent groups, C-FAR has made a significant impact on the way in which the research and outreach agendas are being defined in the College.

Every Extension unit has a local council, which provides ongoing input in Extension program planning and evaluation. Councils are active in helping to identify local needs and provide formal and informal feedback

on Extension activities. During 2003, 4,852 volunteers served on local Extension councils and planning committees throughout the State. The chair of each council, or his/her designee, also serves on the regional advisory council in each of the five regions in Illinois. Finally, Extension has a state advisory committee made up of three representatives from each region who meet at least twice a year for a multiple-day session with the state Extension administration to provide input on programming needs and Extension processes.

To strengthen the role of advisory councils at all levels, Extension has initiated an ongoing program of council training. In addition to training that takes place at the council level, a statewide-organized training effort is taking place through regional meetings to strengthen the capabilities of council members. The training sessions have targeted new council members. In addition, Extension has completed a Council Guide that provides all council members with background information on Extension policies, procedures, and programs.

Extension is currently engaged in a multi-year review of all local units, with special emphasis on programming quality, local programming impact, diversity of stakeholder input and the needs of underserved audiences.

In program planning, Illinois relies very heavily on local input. The program planning process is structured on a four-year “rolling” basis. Each year, one of the four core programming areas, Nutrition, Family and Consumer Sciences, Agriculture and Natural Resources, 4-H Youth Development, and Community and Economic Development, is engaged in an in-depth program needs assessment process. As noted in the introduction to this report, the emphasis for 2003-4 is on Agriculture, Natural Resources and Commercial Horticulture. Planning has already begun for the 2004-5 emphasis with 4-H Youth Development. One special focus of the youth effort will be to reach youth who are not currently being served by other youth organizations or school extracurricular activities.

C. Program Review Process

No significant changes have been made in this process.

D. Evaluation of the Success of Multi and Joint Activities

Throughout this report we have reported consistently on integrated Extension and Research activities in terms of programming and outcomes.

Multi-State Activities

The following multi-state activities have both an extension and research component: Midwest Plan Service; Illinois-Indiana Sea Grant Program; North Central Regional Center for Rural Development (NCRCRD); the Agri-Ecology/Sustainable Agriculture Program; the National Needs Assessment for Agricultural Safety and Health; and the FSNEP National Program Coordinators Team. All are ongoing processes that include institutionalized review. Illinois participates in the institutionalized reviews of each of these groups, but does not necessarily undertake an evaluation of its own. The entities just mentioned each have an advisory or executive committee that is multi-state and combines Extension and research representation. The committees report to the North Central Regional Extension Directors at regular intervals.

The Illinois-Indiana Sea Grant Program was evaluated in preparation for the hiring of a new Extension specialist in aquaculture. As part of the preparation for the hiring process, representatives from the University of Illinois, Purdue University, and the Sea Grant program evaluated the accomplishments of the program and identified the directions in which the program needs to progress. Specific impacts from Sea Grant efforts are reported under Goal 4 of the programs section of this report.

The collaboration between the University of Illinois and Purdue University in terms of producing the grain and livestock marketing newsletters (Ag Outlook Guide) has been a very successful ongoing activity. The collaboration has allowed both states to provide useful and timely information to producers in areas in which they may not have sufficient research and outreach strength to carry out this activity independently. A similar collaboration exists to produce the National Pork Industry Handbook – a resource with a national reputation.

The fact sheets for the Local Government Information and Education Network have undergone peer review as well. The Journal of Extension is itself a peer reviewed publication.

The multi-state conferences are evaluated to they have contributed to improved program development and implementation to meet the needs of

Illinois stakeholders. For some it is too soon to assess their overall impact in meeting the needs of all Illinois citizens. The Spanish language conference has been evaluated by the cooperating states. A report of the follow-up efforts by the states was presented to the North Central state Directors who have agreed to continue the regional efforts in Spanish language programming.

E. Multi-State Activities

E. Multi-State Activities
 U.S. Department of Agriculture

Cooperative State Research, Education, and Extension Service
 Supplement to the Annual Report of Accomplishments and Results
 Multistate Extension Activities and Integrated Activities
 (Attach Brief Summaries)

Institution: University of Illinois
 State: Illinois

Check one: X Multistate Extension Activities
 _____ Integrated Activities (Hatch Act Funds)
 _____ Integrated Activities (Smith-Lever Act Funds)

Title of Planned Program/Activity	Actual Expenditures				
	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
Midwest Plan Service	23,112	22,896	22,896	20,000	
Illinois-Indiana Sea Grant Program	31,190	70,509	5,000	3,689	
NCRC for Rural Development	2,684	2,684	2,684		
Part-time Farming/Sustainable Agriculture	37,903	33,311	39,436	24,322	
Farm Progress Show	12,709			24,358	
IL-Missouri Strategies & Opportunities Conf.	22,600				
Illinois Outlook Guide	4,275	5,000	5,150		
National Needs Assessment	11,000	11,000	11,000		
FSNEP Nat'l. Prog. Coordinators Team	8,684	7,845			
National Pork Industry Handbook		2,932	2,932		
4-H National Centennial Celebration			10,000		
Local Gov't Information & Education Network			51,000	49,600	
Neld Assessment			7,500		
Journal of Extension Professionals Assessment			2,000		
Multi-State Conferences			14,065	66,726	
Distance Diagnostic Training				11,500	
Regional Forage Livestock Program				6,500	
New Horizon Spanish Radio Program				25,800	
Total	154,157	156,177	173,663	232,495	

Multistate Extension Activities (continued)

Glenn Steinhilber, Ph.D.
Director

2/16/04
Date

Multi-State Extension Activities

Midwest Plan Service - Midwest Plan Service provides a regional opportunity to publish research-based Extension publications of use to the North Central Region. States in the North Central Region participate financially in Midwest Plan Service and are users of the publications. The base of publications for Midwest Plan Service has been in agricultural engineering, but more recently farm management and agricultural production areas have been added to the publications of Midwest Plan Service.

Illinois-Indiana Sea Grant Program - The Illinois-Indiana Sea Grant Program provides up-to-the-minute information on great Lakes issues, emphasizing concerns in the southern Lake Michigan region. Topics addressed include water quality, aquaculture and seafood safety, biological resources, sustainable coastal development, and coastal processes. It is funded by NOAA, University of Illinois, and Purdue University. <http://www.iisgcp.org/>

North Central Region Center for Rural Development (NCR CRD) - NCR CRD coordinates and supports research and Extension activities in the areas of community and economic development throughout the North Central Region. The NCR CRD has a number of programmatic emphases which vary over time as the needs arise. Funding is provided to Iowa State for coordinating programs.

Agroecology/Sustainable Agriculture Program (Part-time Farming) - The Agroecology/Sustainable Agriculture Program (ASAP) promotes research and extension which protects Illinois' natural and human resources while sustaining agricultural production over the long term. The program includes cooperative efforts of North Central land grant institutions and other partners, as facilitated and funded in part by the USDA Sustainable Agriculture Research and Education (SARE) program through the University of Nebraska. SARE offers competitive grants related to applied research and extension pertaining to sustainable agriculture.

Ag Outlook Guide - This is a collaborative effort of Illinois, Purdue and Indiana to produce grain and livestock price newsletters.

Farm Progress Show – The Farm Progress Show is one of the premier opportunities in the Midwest for producers and others associated with agriculture to learn about current innovative technology. The show rotates between Illinois, Iowa and Indiana. When the Farm Progress Show is

located in Illinois, the College of Agricultural, Consumer and Environmental Sciences puts together a major display that integrates the education Research and Extension functions of the College.

National Needs Assessment for Ag Safety and Health - Three year project to convene a consensus-building process that would host a conference and publish a document on ag safety and health to serve as a resource in national policy discussions. Representatives from Colorado State, Purdue, University of California and others are included on the planning committee.

FSNEP National Program Coordinators Team - The Food Stamp Nutrition Education Program National Program Coordinators Team is funded by the North Central Region to facilitate communication between FNS and CSREES and to build state capacities for effective program delivery and evaluation to ensure the quality of the nutrition education programming associated with FSNEP.

National Pork Industry Handbook - This is a collaborative effort of Illinois, Purdue and other states to provide pork producers with up-to-date information on all phases of pork production and marketing.
<http://www.extension.iastate.edu/Publications/PM1420.pdf>

4-H Centennial Celebration - Travel to participate in the national 4-H Centennial Celebration in Washington, D.C.

Local Government Information & Education Network - This program provides a variety of educational programs, materials and services to local government officials. Includes an annual series of informational updates via audio conferences, planning of annual conferences for professional associations, quarterly newsletters, fact sheets, and a series of publications on the roles and responsibilities of governmental officials. The network continues to work in areas of poverty, land use and civic education. As a result of work with the multi-state land use team, the fact sheets, written by Extension staff in Indiana and Ohio, have been adapted for Illinois.
<http://www.uiuc.edu/UI-Service/programs/UIUC289.html>

NELD North Central Assessment - NELD North Central is a program of the twelve north central states' Cooperative Extension Services as part of the National Extension Leadership Development Program. The program is to enhance leadership in the Cooperative Extension Service at all levels and provide vision as well as cutting-edge organizational tools for Extension leaders and administrators.
<http://www.aces.uiuc.edu/~neld/about.html>

Journal of Extension Professionals Assessment - The Journal of Extension is the peer-reviewed journal of the U.S. Cooperative Extension System. It seeks to expand and update the research and knowledge base for Extension professionals and other adult educators to improve their effectiveness. journal. <http://www.joe.org/>

Multi-State Conferences - FY03 Multi-State conferences attended by Extension personnel: NCRCRD/Iowa State University “Spanish Speaking Populations Conference” in Chicago 12/01; “National Family Life Extension Specialist Conference” in Kansas City 3/02; “Cooperative Extension and the Digital Divide-Exploring Opportunities Conference” in Nebraska, 11/01; “National CRED Conference” in Florida, 2/02; Several “National Extension Leadership Development Conferences” (NELD) in Houston.

Distance Diagnostic Training - This agreement between the University of Illinois and the University of Georgia Cooperative Extension Services provides increased coordination and multi-state expansion of distance diagnostics technology by providing a system to facilitate rapid submission of text and digital images as educational tools for solving problems related to agricultural crops and their pests and for archiving data for future educational uses.

Regional Forage Livestock Program - Development of a CD on horse pasture management co-sponsored by the University of Illinois and the University of WI. CD is being sold in IL, WI and several other states as a regional forage-livestock program.

New Horizon Spanish Radio Program - The program is used by the University of Illinois and is distributed bi-weekly and free of charge to communities in IL, IA, KS, MI, MN, MO, OH, and VA. The program is produced by University of Illinois students to educate and entertain and geared toward Hispanic populations who have come to the U.S. looking for a new start. New Horizon becomes a part of that new beginning by providing interviews on current topics of interest as well as informative sections related to health and Hispanic culture. New Horizon programs are also distributed to radio stations throughout the Midwest.

North Central Cooperative Extension Association - Assessment to support Executive Director of North Central Cooperative Extension Association/University of Wisconsin.

ECOP Sub-Committee
CSREES Admin Officers Conf Planning Meeting

NEAFCS/NC Director's Meeting
ECOP Meeting
NAE 4-H National Conference
NCR ANR Program Leader Meeting
Extension Pharmacy Conference
NELD Conference
NC Administrative Leadership Conference
NCR Administrative Officers' Conference
CSREES HPHC Meeting
NASULGC New Director/Administrator Orientation
NELD Conference
National Extension Directors ECOP Mtg
Nat'l Pork Board & NPPC Extension
Bridging Gap Between Research & Practice
NASULGC National Leadership Seminar
NC Leadership Conference
NCR ANR Conference
NELD Conference
CSREES Administrative Officers' Conference
Extension Urban Conference
NC Directors Meeting
CYFAR Annual Conference
HPHC Initiative Meeting
NASULGC CECEPS Meeting
Joint AHS/COP Summer Meeting
NACAA Conference
NCR FCS Meeting
Galaxy Conference
NC Directors Meeting
Healthy People Healthy Community Team Mtg/CSREES
NELD Conference

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F. Integrated Activities (Smith-Lever Act)

F. Integrated Activities (Smith-Lever Act)

U.S. Department of Agriculture
 Cooperative State Research, Education, and Extension Service
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 (Attach Brief Summaries)

Institution University of Illinois
 State Illinois

Check one: Multistate Extension Activities
 Integrated Activities (Hatch Act Funds)
 Integrated Activities (Smith-Lever Act Funds)

Actual Expenditures

Title of Planned Program/Activity	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
Part-Time Farming	37,903	33,311	39,436	24,322	
Illinois-Indiana Sea Grant Program	31,190		5,000	3,689	
Farm Progress Show	12,709			24,358	
Pest Management Program	4,500				
Illinois Environmental Policy Review	2,500				
Program Support for new faculty w/joint appts.	158,131	107,429	54,468	82,500	
Ag Entrepreneur Dev Initiative	175,355	195,874	229,181	237,141	
Conferences and Field Days		60,085	40,627	75,444	
Integrated Swine Program		35,400	14,825	2,500	
Information Technology Support		9,319	45,411	30,726	
Global Value-Added Ag Center Initiative		85,000	50,874	39,979	
Human-Environment Research Lab Program			27,694		
Amish Growers Program			3,333	4,000	
Intentional Harmony: Balancing Work & Life				22,000	
Lab for Community & Economic Development				50,000	
Marketing Risk Management Program				3,600	
North Central Cooperative Extension Association				10,947	
Total	422,288	527,138	510,849	611,206	

2/16/04
Date

Shirley A. ...
Director

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Integrated Activities (Smith-Lever Act Funds)

Illinois-Indiana Sea Grant Program - The Illinois Indiana Sea Grant Program provides up-to-the-minute information on Great Lakes issues, emphasizing concerns in the southern Lake Michigan region. Topics addressed include water quality, aquaculture and seafood safety, biological resources, sustainable coastal development, and coastal processes. It is funded by NOAA, University of Illinois, and Purdue University.
<http://www.iisgcp.org/>

Agroecology/Sustainable Agriculture Program (Part-time Farming) - The Agroecology/Sustainable Agriculture Program (ASAP) promotes research and extension which protects Illinois' natural and human resources while sustaining agricultural production over the long term. The program includes cooperative efforts of North Central land grant institutions and other partners, as facilitated and funded in part by the USDA Sustainable Agriculture Research and Education (SARE) program. SARE offers competitive grants related to applied research and extension pertaining to sustainable agriculture.

Farm Progress Show - The Farm Progress Show is one of the premier opportunities in the Midwest for producers and others associated with agriculture to learn about current innovative technology. The show rotates between Illinois, Iowa, and Indiana. When the Farm Progress Show is located in Illinois, the College of Agricultural, Consumer and Environmental Sciences puts together a major display that integrates the education research and Extension functions of the College.

Pest Management Program - On-farm applied research and extension efforts in fruit and vegetable entomology.

IL Environmental Policy Review - Newsletter articles written by researchers that educate city and county officials and citizens of Illinois about state, regional and federal policies and issues concerning the environment including safe food and the quality of air and water.

Program Support - Program support for new faculty and faculty who have joint research/extension appointments.

Agricultural Entrepreneur Development Initiative - Designed to provide resources and technical assistance in business planning, product development, value added products and marketing. Program is associated with research projects funded by state funds. The "Illinois Branded

Livestock Project” is an example of product development under this initiative.

Conferences - Various beef, dairy, sheep, swine and grazing meetings and conferences as well as Agronomy Days, Corn/Soybean Classics, Field Days and the Livestock Waste Management Conference showcasing current research and extension initiatives.

Integrated Swine Program - This is a multi-discipline applied research project involving research and extension to investigate approaches to improving physical and financial performance of Illinois swine farms. The research will be carried out on producer units and data will be collected that will allow full economic evaluation of management changes.

http://www.ansci.uiuc.edu/ellislab/ISP_Publications/9_isp_publicationsWF02.html

Information Technology Support - Support for services related to the design, development and web management of research and extension programs as well as program impact and reporting systems.

Global Value-Added Agriculture Center Initiative - This project involves an analysis of value-enhanced crop and livestock markets, technology, farm surveys, and strategic planning for different eco-regions. This project has added a global dimension by investigating markets for value-enhanced corn and soybeans in Japan and Mexico. The project conducts conferences, workshops, and business development meetings for Illinois producers who are interested in pursuing new value-added opportunities.

Human - Environment Research Laboratory Program - This is a multi-disciplinary research lab dedicated to studying the relationship between people and the physical environment. The mission is to generate information about human-environment relationships to guide policy, planning, and design of environments brought by theory and research methods of psychology and concerns of environmental design, policy and planning. <http://www.herl.uiuc.edu>

Amish Growers Program - Funding used to conduct a workshop March 22, 2003 for Amish growers to explore the avenues for improvement of production and marketing of crops. Improvements in the Amish communities included establishing and expanding on-site marketing, increasing sale of crops substantially, starting vegetable production,

starting successful educational and recreational programs to students, residents of the area, and tourists.

Intentional Harmony: Balancing Work & Life - Funds used to develop new research-based program to help people manage their work and their personal lives. The program is firmly based in family theory and interdisciplinary research and it addresses the needs of working individuals systematically across multiple domains. A series of workshops are planned in FY04. Preliminary analyses of the “Managing Work and Children” unit clearly show that parents report better work-life management in the parenting domain four weeks after the workshop.

Lab for Community and Economic Development - Provides practical, research-based information and programs to help individuals, families, organizations, businesses, farms and rural and urban communities throughout Illinois. Additional information may be found at <http://communitydevelopment.uiuc.edu>

Marketing and Risk Management, Putting the Pieces Together Newsletter - The objective is to improve marketing and risk management skill of Illinois grain farmers by opening a regular line of communication with 50 Illinois farmers. The audience is Illinois grain farmers and landowners who are looking to share their marketing and risk management experiences and stay on top of dynamic commodity markets. The farmers meet monthly from their home locations via teleconference communication. In between teleconferences, Extension team (Farm Business Management & Marketing) contributes to and mails the newsletter.

North Central Cooperative Extension Association - Assessment to support Executive Director of North Central Cooperative Extension Association/University of Wisconsin.

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G. Integrated Activities (Hatch Act Funds)

G. Integrated Activities (Hatch Act Funds)

U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Supplement to the Annual Report of Accomplishments and Results
Multistate Extension Activities and Integrated Activities
(Attach Brief Summaries)

Institution: <u>University of Illinois</u>					
State: <u>Illinois</u>					
Check one: <input type="checkbox"/> Multistate Extension Activities					
<input checked="" type="checkbox"/> Integrated Activities (Hatch Act Funds)					
<input type="checkbox"/> Integrated Activities (Smith-Lever Act Funds)					
	Actual Expenditures				
Title of Planned Program/Activity	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
Illinois-Indiana Sea Grant Program	24,952	167,720	185,152	97,454	
Sustainable Agriculture/Part-Time Farming	163,767			11,078	
Farm Progress Show	13,474				
Pest Management Program	6,200				
Illinois Environmental Policy Review	6,808				
Program Support for new faculty w./joint appts.	124,040	177,268	132,265	72,900	
Program Support for res/ext joint appts.		208,481	236,020	255,480	
Conferences and Field Days		17,593	7,298	13,724	
Integrated Swine Program		86,867	62,102	23,035	
Information Technology Support		40,016	42,701		
Global Value-Added Ag Center Initiative			25,000		
Human-Environment Research Lab Program			3,333		
Amish Growers Program				9,458	
Intentional Harmony: Balancing Work & Life				7,749	
Lab for Community & Economic Development				14,209	
Marketing & Risk Management Program				5,000	
North Central AES Association				23,492	
Total	339,241	697,945	693,871	533,579	

Integrated Activities (Hatch Act Funds) (continued)

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Director

11 Feb 04

Date

Integrated Activities (Hatch Act Funds)

Illinois-Indiana Sea Grant Program - The Illinois-Indiana Sea Grant Program provides up-to-the-minute information on Great Lakes issues, emphasizing concerns in the southern Lake Michigan region. Topics addressed include water quality, aquaculture and seafood safety, biological resources, sustainable coastal development, and coastal processes. It is funded by NOAA, University of Illinois, and Purdue University.
<http://www.iisgcp.org/>

Agroecology/Sustainable Agriculture Program - The Agroecology/Sustainable Agriculture Program (ASAP) promotes research and extension which protects Illinois' natural and human resources while sustaining agricultural production over the long term. The program includes cooperative efforts of North Central land grant institutions and other partners, as facilitated and funded in part by the USDA Sustainable Agriculture Research and Education (SARE) program. SARE offers competitive grants related to applied research and extension pertaining to sustainable agriculture.

Farm Progress Show - The Farm Progress Show is one of the premier opportunities in the Midwest for producers and others associated with agriculture to learn about current innovative technology. The show rotates between Illinois, Iowa, and Indiana. When the Farm Progress Show is located in Illinois, the College of Agricultural, Consumer and Environmental Sciences puts together a major display that integrates the education research and Extension functions of the College.

Pest Management Program - On-farm applied research and extension efforts in fruit and vegetable entomology.

IL Environmental Policy Review - Newsletter articles written by researchers that educate city and county officials and citizens of Illinois about state, regional and federal policies and issues concerning the environment including safe food and the quality of air and water.

Program Support - Program support for new faculty and faculty who have joint research/extension appointments.

Conferences - Various beef, dairy, sheep, swine and grazing meetings and conferences as well as Agronomy Days, Corn/Soybean Classics, Field Days and the Livestock Waste Management Conference showcasing current research and extension initiatives.

Integrated Swine Program - This is a multi-discipline applied research project involving research and extension to investigate approaches to improving physical and financial performance of Illinois swine farms. The research will be carried out on producer units and data will be collected that will allow full economic evaluation of management changes.

http://www.ansci.uiuc.edu/ellislab/ISP_Publications/9_isp_publicationsWF02.html

Information Technology Support - Support for services related to the design, development and web management of research and extension programs as well as program impact and reporting systems.

Global Value-Added Agriculture Center Initiative - This project involves an analysis of value-enhanced crop and livestock markets, technology, farm surveys, and strategic planning for different eco-regions. This project has added a global dimension by investigating markets for value-enhanced corn and soybeans in Japan and Mexico. The project conducts conferences, workshops, and business development meetings for Illinois producers who are interested in pursuing new value-added opportunities.

Human - Environment Research Laboratory Program - This is a multi-disciplinary research lab dedicated to studying the relationship between people and the physical environment. The mission is to generate information about human-environment relationships to guide policy, planning, and design of environments brought by theory and research methods of psychology and concerns of environmental design, policy and planning. <http://www.herl.uiuc.edu>

Amish Growers Program - Funding used to conduct a workshop March 22, 2003 for Amish growers to explore the avenues for improvement of production and marketing of crops. Improvements in the Amish communities included establishing and expanding on-site marketing, increasing sale of crops substantially, starting vegetable production, starting successful educational and recreational programs to students, residents of the area, and tourists.

Intentional Harmony: Balancing Work & Life - Funds used to develop new research-based program to help people manage their work and their personal lives. The program is firmly based in family theory and interdisciplinary research and it addresses the needs of working individuals systematically across multiple domains. A series of workshops are planned in FY04. Preliminary analyses of the "Managing Work and

Children” unit clearly show that parents report better work-life management in the parenting domain four weeks after the workshop.

Lab for Community and Economic Development - Provides practical, research-based information and programs to help individuals, families, organizations, businesses, farms and rural and urban communities throughout Illinois. Additional information may be found at <http://communitydevelopment.uiuc.edu>

Marketing and Risk Management, Putting the Pieces Together Newsletter - The objective is to improve marketing and risk management skill of Illinois grain farmers by opening a regular line of communication with 50 Illinois farmers. The audience will be Illinois grain farmers and landowners who are looking to share their marketing and risk management experiences and stay on top of dynamic commodity markets. The farmers meet monthly from their home locations via teleconference communication. In between teleconferences, Extension team (Farm Business Management & Marketing) contributes to and mails the newsletter.

North Central AES Association - Assessment to support Executive Director of North Central AES Association/University of Wisconsin.

File: integratedhatchfunds03.wpd

APPENDIX A: FY2003 Annual Report Statistical Tables

Table 1 - University of Illinois College of ACES: Research Funding and Staff Support

EXPENDITURES AND STAFF SUPPORT (FY 2003)							
	GOAL I	GOAL II	GOAL III	GOAL IV	GOAL V	TOTAL	MULTI-STATE
Total CSREES Research	7,919,110	1,017,108	575,726	1,176,734	705,645	11,394,323	1,479,080
Total Other Federal Research Funds	4,858,223	259,737	304,418	865,710	389,430	6,677,518	280,849
Total Non-Federal Funds	27,281,208	3,473,558	1,967,397	6,813,306	4,074,030	43,609,499	7,810,121
Total All Research Funds	40,058,541	4,750,403	2,847,541	8,855,750	5,169,105	61,681,340	9,570,050
Total Number of Research Projects	275	24	30	82	48	459	59
Scientist Years	82	14.2	5.9	27.4	21.8	151.30	21.2
Professional and Technical Support	402.7	38.9	31.3	97.7	50.6	621.20	90.4
Total Staff Support	484.7	53.1	37.2	125.1	72.4	772.50	111.6

Table 2 - College of ACES: U of I Extension Funding and Teaching Contacts

	GOAL I	GOAL II	GOAL III	GOAL IV	GOAL V	TOTAL
Federal Funding - All Sources	\$2,211,977	\$873,306	\$2,215,566	\$741,712	\$5,920,537	\$11,963,097
State Funding	\$6,451,953	\$2,547,283	\$6,462,422	\$2,163,446	\$17,269,182	\$34,894,286
Local Funding	\$2,541,001	\$1,003,207	\$2,545,123	\$852,039	\$6,801,196	\$13,742,567
Other Funding	\$2,148,321	\$848,174	\$2,151,807	\$720,367	\$5,750,157	\$11,618,826
Total Estimated Expenditures by GPRA Goal	\$13,353,252	\$5,271,971	\$13,374,917	\$4,477,564	\$35,741,072	\$72,218,776
Estimated Teaching Contacts by Goal	310,072	281,790	694,191	158,636	1,126,132	2,571,078
Estimated Knowledge/Practice Changes using the conservative assumption that 50% of participants achieve some level of change	155,036	140,895	347,096	79,318	563,066	1,285,539
Total 4-H Youth in 4-H Enrollment System					300,735	
Note: Values are extrapolated from the Extension reporting system used to meet U of I positive time reporting requirements and monitor U of I Extension's affirmative action program.						

Expenditure data source: fy03uie-expend-source.xls; Effort and Audience Count Source: file: 2003 Effort and Audience Counts by GPRA.xls